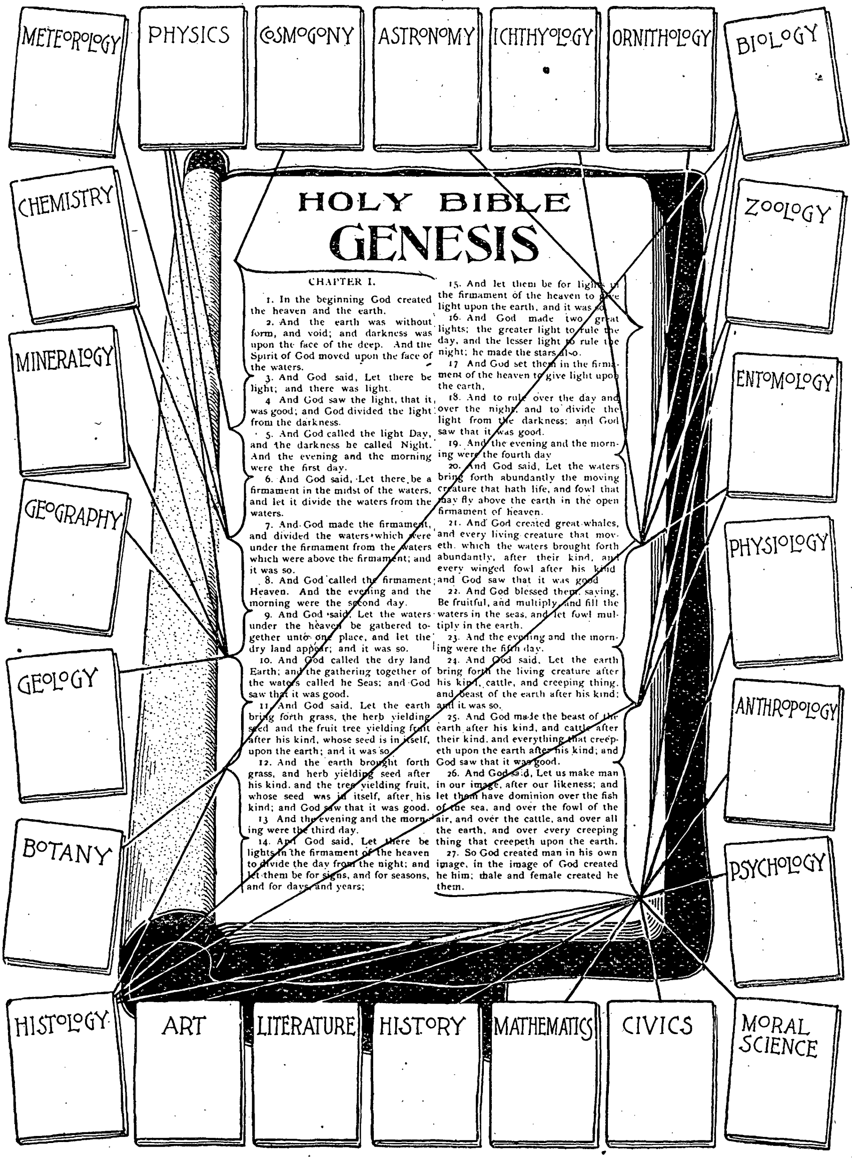
BIBLE NATURE STUDIES

M. E. CADY



THE BOOK OF BOOKS
THE FOUNDATION OF
TRUE SCIENCE

BIBLE NATURE STUDIES

A MANUAL FOR THE

HOME & SCHOOL

Designed to aid parents and teachers in educating the children and youth to behold the Creator in His creation

By Marion Ernest Cady

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Preface.

The world is full of books on science and nature; and this book would not have appeared had it not been that the author saw a place for it which is not occupied by other works that have been written. The prime object of this work is not to fill the mind with a multitude of facts found in nature, but rather to fill the heart with nature's wonderful lessons which the Creator has written in earth, sea, and sky. The tendency of the study and investigation of science in these modern times is to lead the minds of students away from the Creator, and from the contemplation of His power, wisdom, and love, so plainly manifested in all His works. Now, as in olden times, the inclination is "to worship and serve the *creature* more than the *Creator*."

The study of nature, carried on in the right way, is a great factor in character building. It will lead the children and youth to love and reverence their Maker, instead of growing up with their minds filled with infidelity and skepticism. Creation and revelation have one and the same God; therefore the study of the Bible and nature should go hand in hand. These are the two great books which the child of God will study throughout eternity. Why not have the children study them diligently now?

Read carefully the introduction, and study thoroughly the introductory lessons before taking up the lessons in chapter one. If this is done, the plan and scope of the book will be better understood, and more satisfactory results obtained.

It is not expected that this book will be placed in the hands of the children before they reach the sixth grade. But the parent or teacher will use it as a guide in teaching Nature study in the lower grades. Children who can read well can use it as a text-book to good advantage. The "Nature Study

Note-book," with over 200 drawings, will greatly aid the teacher, and serve to increase the interest of the children by stimulating them to faithfulness and neatness in the matter of keeping notes of all their work.

"Parts of His Ways," which is now in preparation, is calculated for a general reading book, rather than a text-book for school use. It will be a great aid to parents and teachers, as the language is much simplified, and the different phases of nature are fully illustrated.

It is hoped that this series of Bible-Nature studies may be helpful to both parents and teachers in the responsible work of training and educating the children for this world and the world to come.

M. E. C.

Contents.

INTRODUCTION.

INTRODUCTORY LESSONS.

CHAPTER ONE.

THE EARTH IN THE BEGINNING.

CHAPTER TWO.

LIGHT AND HEAT.

CHAPTER THREE.

AIR AND SOUND.

CHAPTER FOUR.

WATER.

CHAPTER EIGHT.

THE WATER ANIMALS.

CHAPTER NINE.

THE AIR ANIMALS.

CHAPTER TEN.

THE LAND ANIMALS.

CHAPTER ELEVEN.

MAN.

Introduction.

At the present time, Nature study is one of the most interesting and fascinating lines of study carried on in the public school; but so much mythology is taught in connection with it, that the highest and best results are not obtained. In this line of educational work, just as in all others, we are not left to grope in darkness; for the Lord has spoken plainly on the subject, both in the Word and through the spirit of prophecy. Below are some extracts which we believe set forth clearly, in a few words, the object and the importance of Bible-Nature study:—

THE BIBLE AND NATURE.—As divine truth is revealed in Holy Writ, so it is reflected, as from a mirror, in the face of Nature; and through His creation we become acquainted with the Creator. And so the book of Nature becomes a great lesson-book, which instructors who are wise can use in connection with the Scriptures, to guide lost sheep back to the fold of God.—*Special Testimonies on Education, page 59.*

God has, in the natural world, placed in the hands of the children of men the key to unlock the treasure-house of His Word. The unseen is illustrated by the seen; divine wisdom, eternal truth, infinite grace, are understood by the things that God has made. Then let the children and youth become acquainted with Nature and Nature's laws.—*Id., page 61.*

The whole natural world is designed to be an interpreter of the things of God. To Adam and Eve in their Eden home, Nature was full of the knowledge of God, teeming with divine instruction. It was vocal with the voice of wisdom to their attentive ears. Wisdom spoke to the eye and was received into the heart; for they communed with God in His created works.—*Id., page 59.*

CHRIST AS A STUDENT OF NATURE.—And day by day He gained knowledge from the great library of animate and inanimate Nature. He who had created all things, was now a child of humanity, and He studied the lessons which His own hand had written in earth and sea and sky. The parables by which, during His ministry, He loved to teach His lessons of truth, show how open His spirit was to the influences of Nature, and how, in His youth, He had delighted to gather the spiritual teaching from the surroundings of His daily life. To Jesus the significance of the Word and works of God unfolded gradually, as He was seeking to understand the reason of things, as any youth may seek to understand.—*Id., page 158.*

Every child may gain knowledge as Jesus did, from the works of Nature and the pages of God's Holy Word.—*Id., page 159.*

Jesus, under the Divine Teacher, studied the words of God, pure and uncorrupted, and studied also the great lesson book of Nature. —*Id., page 162.*

His early years were given to the study of God's Word. And spread out before Him was the great library of God's created works. He who had made all things studied the lessons which His own hand had written in earth and sea and sky. Apart from the unholy ways of the world, He gathered stores of scientific knowledge from Nature. He studied the life of plants and animals, and the life of man. From His earliest years He was possessed of one purpose; He lived to bless others. For this He found resources in Nature; new ideas of ways and means flashed into His mind as He studied plant life and animal life. Continually He was seeking to draw from things seen illustrations by which to present the living oracles of God. The parables by which, during His ministry, He loved to teach His lessons of truth, show how open His spirit was to the influences of Nature, and how He had gathered the spiritual teachings from the surroundings of His daily life.—*Desire of Ages, page 70.*

His hours of happiness were found when alone with Nature and with God. Whenever it was His privilege, He turned aside from the scenes of His labor, to go into the fields, to meditate in the green valleys, to hold communion with God on the mountain-side, or amid the trees of the forest.—*Id., pages 89-90.*

CHRIST AS A TEACHER OF NATURE.—The words of Christ placed the teachings of Nature in a new aspect, and made them a new revelation. He could speak of the things which His own hands had made; for they had qualities and properties that were peculiarly His own. In Nature, as in the sacred pages of the Old Testament Scriptures, divine, momentous truths are revealed; and in His teaching, Jesus laid these open before the people, bound up with the beauty of natural things.—*Special Testimonies on Education, page 64.*

In His teaching, He drew His illustrations from the great treasury of household ties and affections, and from Nature. The unknown was illustrated by the known; sacred and divine truths, by natural, earthly things, with which the people were most familiar. These were the things that would speak to their hearts and make the deepest impression on their minds.—*Id., page 64.*

The same principle appeared in His teaching; the unknown was illustrated by the known. Jesus taught by illustrations and parables drawn from Nature and from the familiar events of every-day life. —*Id., page 67.*

NATURE AS AN EDUCATOR.—MOSES.—The education received by Moses, as the king's grandson, was very thorough. Nothing was neglected that was calculated to make him a wise man, as the Egyptians understood wisdom. This education was a help to him in many respects; but the most valuable part of his fitting for his life work was that received while employed as a shepherd. As he led his flocks through the wilds of the mountains and into the green pastures of the valleys, the God of Nature taught Him the highest and grandest wisdom. In the school of Nature, with Christ Him-

self for teacher, he contemplated and learned lessons of humility, meekness, faith, and trust, and of a humble manner of living, all of which bound his soul closer to God. In the solitude of the mountains he learned that which all his instruction in the king's palace was unable to impart to him,—simple, unwavering faith, and constant trust in the Lord.—*Id., page 115.*

David.—Before him spread a landscape of rich and varied beauty. The vines, with their clustering fruit, brightened in the sunshine. The forest trees, with their green foliage, swayed in the breeze. He beheld the sun flooding the heavens with light, coming forth as a bridegroom out of his chamber, and rejoicing as a strong man to run a race. There were the bold summits of the hills reaching toward the sky; in the far-away distance rose the barren cliffs of the mountain wall of Moab; above all spread the tender blue of the over-arching heavens; and beyond was God. He could not see Him, but His works were full of His praise. The light of day, gilding forest and mountain, meadow and stream, carried the mind up to behold the Father of lights, the Author of every good and perfect gift. Daily revelations of the character and majesty of his Creator filled the young poet's heart with adoration and rejoicing. In contemplation of God and His works, the faculties of David's mind and heart were developing and strengthening for the work of his after life.—*Christian Education, page 204.*

John the Baptist.—John the Baptist was not fitted for his high calling as the forerunner of Christ by association with the great men of the nation in the schools at Jerusalem. He went out into the wilderness, where the customs and doctrines of men could not mold his mind, and where he could hold unobstructed communion with God.—*Special Testimonies on Education, page 46.*

Joseph.—A pure and simple life had favored the vigorous development of both physical and intellectual powers. Communion with God through His works, and the contemplation of the grand truths intrusted to the inheritors of faith, had elevated and ennobled his spiritual nature, broadening and strengthening the mind as no other study could do.—*Patriarchs and Prophets, page 222.*

The Responsibility of Parents and Teachers in Teaching Nature.—In this way He associated natural things with spiritual, linking the things of Nature and the life experience of His hearers with the sublime spiritual truths of the written Word. And His lessons were repeated whenever their eyes rested on the objects which had been associated with eternal truths. Here is indicated the higher education that is to be given by parents and teachers. The truth simplified and illustrated is quickly discerned even by children. The figurative language arrests the attention and pleases the mind; and the lesson is firmly fixed in the memory.—*Special Testimonies on Education, page 67.*

Parents should be the only teachers of their children until they have reached eight or ten years of age. As fast as their minds can comprehend it, the parents should open before them God's great book of Nature. The mother should have less love for the artificial in her house, and in the preparation of her dress for display, and should find time to cultivate, in herself and in her children, a love for the beautiful buds and opening flowers. By calling the atten-

tion of her children to the different colors and variety of forms, she can make them acquainted with God, who made all the beautiful things which attract and delight them. She can lead their minds up to their Creator, and awaken in their young hearts a love for their heavenly Father, who has manifested so great love for them. Parents can associate God with all His created works. The only school-room for children from eight to ten years of age should be in the open air, amid the opening flowers and Nature's beautiful scenery. And their only text-book should be the treasures of Nature. These lessons, imprinted upon the minds of young children amid the pleasant, attractive scenes of Nature, will not soon be forgotten. —*Christian Education, pages 8, 9.*

The parable of the sower and the seed conveys a deep spiritual lesson. The seed represents the principles sowed in the heart, and its growth the development of character. Make the teaching on this point practical. The children can prepare the soil, and sow the seed; and as they work, the parent or teacher can explain to them the garden of the heart with the good or bad seed sown there; and that as the garden must be prepared for the natural seed, so the heart must be prepared for the seed of truth. As the plant grows, the correspondence between the natural and the spiritual can be continued.—*Special Testimonies on Education, page 70.*

The little children should come especially close to Nature. Instead of putting fashion's shackles upon them, let them be free, like the lambs, to play in the sweet, fresh sunlight. Point them to shrubs and flowers, the lowly grass and the lofty trees, and let them become familiar with their beautiful, varied, and delicate forms. Teach them to see the wisdom and love of God in His created works; and as their hearts swell with joy and grateful love, let them join the birds in their songs of praise. Educate the children and youth to consider the works of the great Master Artist, and to imitate the attractive graces of Nature in their character building.—*Id., page 62.*

The mother should be the teacher, and home the school where every child receives his first lessons; and these lessons should include habits of industry. Mothers, let the little ones play in the open air; let them listen to the songs of the birds, and learn the love of God as expressed in His beautiful works. Teach them simple lessons from the book of Nature and the things about them; and as their minds expand, lessons from books may be added, and firmly fixed in the memory.—*Id., page 37.*

NATURE TEACHES SPIRITUAL TRUTH.—Thus did Christ impress His teachings on the heart by illustrations from the book of Nature. His lessons are for us to-day. Every word is full of assurance, and tends to confirm faith and trust in God. His plainest, simplest teachings contain rich treasures of truth, which are unfolded to the souls that believe His word.—*Id., page 65.*

In His teaching, He drew His illustrations from the great treasury of household ties and affections and from Nature. The unknown was illustrated by the known; sacred and divine truths, by natural, earthly things, with which the people were most familiar.

These were the things that would speak to their hearts and make the deepest impression on their minds.—*Id., page 64.*

All Nature will bear testimony, as designed, for the illustration of the Word of God. The natural and the spiritual are to be combined in the studies of our schools. The operations of agriculture illustrate the Bible lessons. The laws obeyed by the earth reveal the fact that it is under the masterly power of an infinite God. The same principles run through the spiritual and the natural world.—*Id., page 215.*

HOLY SPIRIT AS A TEACHER OF NATURE.—As the works of God are studied, the Holy Spirit flashes conviction into the mind. It is not the conviction which logical reasoning produces; but unless the mind has become too dark to know God, the eye too dim to see Him, the ear too dull to hear His voice, a deeper meaning is grasped, and the sublime, spiritual truths of the written Word are impressed on the heart.—*Id., page 59.*

There is need of a close study of Nature, under the guidance of the Holy Spirit.—*Youth's Instructor, May 6, 1897.*

BENEFITS OF THE STUDY OF NATURE.—Work in the garden and field will be an agreeable change from the wearisome routine of abstract lessons to which their young minds should never be confined. To the nervous child, who finds lessons from books exhausting and hard to remember, it will be especially valuable. There is health and happiness for him in the study of Nature; and the impressions made will not fade out of his mind, for they will be associated with objects that are continually before his eyes.—*Special Testimonies on Education, page 61.*

There is a refining, subduing influence in Nature that should be taken into account in selecting the locality for a school. God has regarded this principle in training men for His work.—*Id., page 46.*

And as we behold the beautiful and grand in Nature, our affections go out after God; while the spirit is awed, the soul is invigorated by coming in contact with the Infinite through His created works.—*Id., page 159.*

PLAN OF BIBLE-NATURE STUDIES.—Any work, to succeed, must be executed in accordance with some good plan; and this plan must be well understood and heartily accepted on the part of the one who is to execute the work. The accompanying chart is a diagrammatical representation of the plan followed by the author in the preparation of this series of lessons on Bible-Nature study. The key-note of this plan is expressed in the following statements, found in "Special Testimonies on Education:" "The power and soul of true education is a knowledge of God, and of Jesus Christ whom He hath sent."—*P. 16.* "'And this is life eternal, that they might know Thee the only true God, and Jesus Christ, whom Thou

hast sent.' Every instructor of youth is to work in harmony with this prayer, leading the students to Christ."—*P. 24.* "The true higher education is that which makes students acquainted with God and His Word, and fits them for eternal life."—*P. 23.* From these quotations, it is plain that the *true higher education* is a knowledge of *God* and of *Christ.* So the words "God" and "Christ" appear in the center of the diagram, because the knowledge of them is the power, the soul, the very center of the true higher education. The text of Scripture which emphasizes this thought you will find in the first circle surrounding the center. No matter what may be the line of study, whether history, language, philosophy, or science, all of them should lead to a knowledge of God and Christ. This knowledge is comprehended in the work of creation and redemption; accordingly these words occur in the second circle.

True science gives us the ability to correctly interpret the handwriting of the Creator in the natural world. In order that the study of Nature—God's marvelous works—may be carried on in harmony with the principles of true higher education, it must lead to a knowledge of God and of Christ, as the following quotations plainly indicate: "In this way He associated natural things with spiritual, linking the things of Nature and the life-experience of His hearers with the sublime, spiritual truths of the written Word. . . . Here is indicated the *higher education* that is to be given by parents and teachers."—*Special Testimonies on Education, p. 67.* "The listening ear can hear and understand the communications of God through the things of Nature. The green fields, the lofty trees, the buds and flowers, the passing cloud, the falling rain, the babbling brook, the glories of the heavens, speak to our hearts, and invite us to become *acquainted* with Him who made them all."—*Steps to Christ, p. 96.* In harmony with the above, we read in the Scriptures, "*Acquaint* now thyself with Him, and be at peace: thereby good shall come unto thee." Job 22:21.

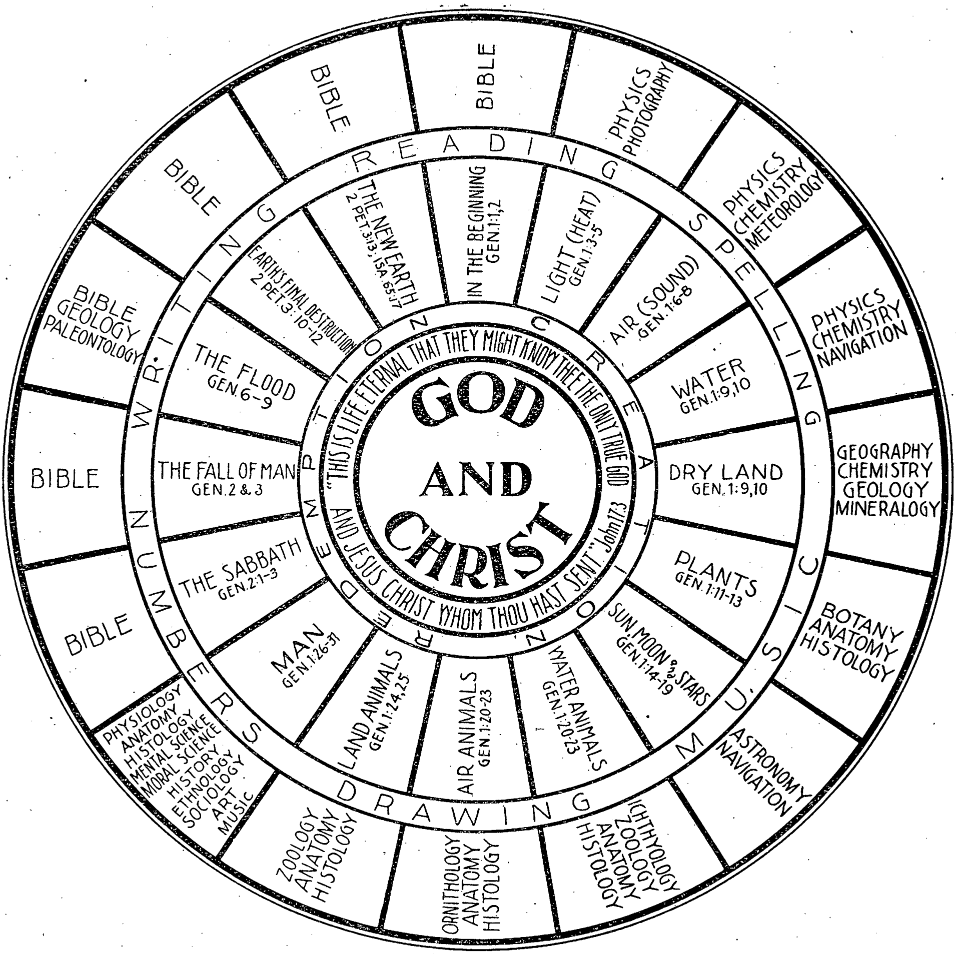

CHART OF THE TRUE
"HIGHER EDUCATION"

How shall the pupil become acquainted with God and Christ in the study of Nature?—By connecting the works of God with the study of His Word. They have one and the same Author. The Bible contains the only authentic record of creation. Accordingly, the Word of God should be used as the basis of Nature study. The first chapter of Genesis contains the brief yet comprehensive story of how God created the world and all things that are therein. This chapter contains the plan of study adopted in writing these lessons. After the pupil has studied the principles contained in the first five lessons, he is prepared to take up understandingly the study of Nature itself, for he knows how and why it should be studied, as well as some of the benefits to be received. The next five lessons are based on Gen. 1:1, 2, showing the condition of the earth "In the Beginning." This subject is indicated in the diagram, in the section directly above. The next subjects to be studied are "Light and Heat," which you will find in the first section to the right. In the next section you will find the subjects "Air and Sound;" in the next, the "Dry Land," and so on around, until you come to the starting-point. This diagram indicates the order of study throughout the year, or term of school. The order of study, you will observe, is the order of creation. It is the constructive instead of the destructive process. The pupil sees God building, and not tearing down. The wisdom of the Creator should be seen at every step. Why did God create the light first, and the atmosphere second? Why did He then cause the dry land to appear? Why did God cause vegetation to appear next? Did God exercise as much wisdom in building the grand temple of Nature as does the earthly mechanic in erecting a building? He has good reasons for laying the foundation first, and for placing the frame upon this next. Show the pupil that there is a proper order in creation, and that the order of creation is the proper order of study. Light, heat, air, land, water, etc., all bear certain

relationships to each other, and all help to do their part in carrying out the great purpose of God in their creation.

After the six days of creation were past, God rested, taking great delight in beholding what He had made. This day of rest He called "The Sabbath," and gave it to Adam and Eve, and all their posterity, that they might spend it in beholding the great love of God, as revealed in the things He had made. But Adam and Eve failed to stand the test of loyalty, so the pupils next study "The Fall of Man," noting the terrible effects of sin, not only upon man, but upon all the creation of God. It is seen in the antagonism between the animals; in the degeneration of plants; in the land convulsed by earthquakes and volcanoes; in the ocean, with its tidal waves; in the atmosphere, with its tornadoes and cyclones. Next the pupil takes up the study of "The Flood," the culminating curse which came on account of the great wickedness of the antediluvians. The light of the gospel is seen shining amid the great darkness, for God, through Noah, warned the world of the great destruction which was soon to come upon the earth, thus giving all an opportunity to be saved. The animal fossils and coal deposits can be taken up with great interest right at this point, and establish faith in the inspired Word.

The great forbearance of God still preserves the earth, and yet His Word plainly declares that the earth, once destroyed by a flood, will finally be destroyed by fire. So the subject, "Earth's Final Destruction," naturally follows the study of the flood. Out of this great conflagration comes forth the "New Earth." God's great plan, though thwarted apparently for a time, is now accomplished by the redemption of the earth and of all those who were loyal to their Creator. By carefully studying the plan as indicated by the chart, you will readily see that the two great themes of study are "Creation" and "Redemption." All the subjects are written toward the center, thus indicating that each reveals some attribute of God as Creator, and of Christ as Redeemer.

In the study of these topics, each one should be considered under four heads: (1) Its Origin; (2) Its Nature; (3) Its Utility; and (4) Its Lesson of Spiritual Truth. Let us take one of the topics,—plants,—to illustrate the method of study. The origin of plants is plainly given in Gen. 1:11, 12, which shows that God brought plants into existence. The nature of plants is learned by considering "how they grow,"—how they are related to light, heat, air, soil, and water, and how they are constructed so that they can utilize these in their processes of growth. The utility of plants is recognized in seeing how they adorn the earth, and how they are of vital consequence to man and the lower animals in maintaining their existence. As a symbol, plants are often used in the Bible to teach lessons of spiritual truths. For example, in Ps. 1:1-3 and Jer. 17:7, 8, the righteous man is represented as a tree by the rivers of waters, which bears fruit, and is not affected by the drought of summer. Again, David says that the righteous are to flourish like the palm tree, and to grow like the cedar of Lebanon. The Bible is filled with these symbols borrowed from Nature to illustrate divine truths; and these the pupils need more, yea, infinitely more, than they need the facts which minister only to the temporal life.

You observe reading, writing, spelling, numbers, drawing, and music, in the circle surrounding the subjects for study. This indicates that at the time when the child is getting a knowledge of Nature, he should also be learning how to express himself with reference to it, through language, mathematics, drawing, etc. The reading, writing, and spelling lessons, etc., may be upon the lesson for the day in Nature study. Between this circle and the center of the diagram, we have the subjects for study during the child period,—from three to twelve or fifteen years of age. The outer portion of the diagram contains the subjects for study during the youth period, as given by man in his study of God's creation. Man has many more subjects, but it is because he has dissected

Nature, and given a name to each part. The study of plants is called botany; the study of animals, zoology. But if we are studying the animals called birds, then we have the study of ornithology; if fishes, we have the study of ichthyology. The child should study simply plants and animals, and the hard scientific names should not be mentioned. During the child period all the subjects should be studied each year. The depth of the study should be regulated by the age and aptness of the child. Each succeeding year, new and more difficult facts should be gleaned under each subject. In the youth period a choice of subjects should be allowed and fewer subjects taken,—perhaps not more than one or two each year.

These lessons are prepared for parents as well as teachers. The parents should begin the work, and the teacher carry it on when the child is old enough to attend school. The lessons are adapted to the season of the year, there being five lessons per week, or two hundred and sixty in all. By beginning about the first of November, you will find that during the cold winter months you can study light and heat, air and sound, dry land and water, so that you are ready when spring arrives to study the plants. If you are a little too early for plants, study the sun, moon, and stars, the work of the fourth day of creation. During the spring and summer months, plants and animals should be studied. In the fall, the plant and animal study will not cease entirely, but study, largely, man, and the remaining subjects, completing the study of all the subjects by the first of the November following. The child will get plenty of vacation in the search for insects, birds, plants, flowers, leaves, etc., which brings health and glow to his cheeks and limbs. The child should not be confined to book-study during the summer; his work should be, largely, observing and collecting.

The abbreviations given below refer to different writings of the Spirit of Prophecy, and will be used in the lessons.

ABBREVIATIONS.

P. P. "Patriarchs and Prophets."
G. C. "Great Controversy."
T. "Testimonies for the Church."
St. C. "Steps to Christ."
Sp. T. Ed. "Special Testimonies on Education."
C. E. "Christian Education."
D. A. "Desire of Ages."
G. W. "Gospel Workers."
R. H. *Review and Herald.*
Sp. G. "Spiritual Gifts."
S. T. *Signs of the Times.*
M. B. "Mount of Blessing."
U. T. Unpublished Testimonies.
Y. I. *Youth's Instructor.*
H. L. "Healthful Living."
C. O. L. "Christ's Object Lessons."
P. T. S. "Principles of True Science."

REFERENCE BOOKS.

The following books are recommended to teachers and parents for use in connection with the Bible-Nature study lessons :—

"Encyclopedia of Nature Teachings."
Published by Thomas Whittaker, 2 and 3 Bible House, New York.
"Bible Teachings in Nature" (MacMillan).
"The Ministry of Nature" (MacMillan).
"Two Worlds Are Ours" (MacMillan).
Published by MacMillan & Co., New York.
"Child's Book of Nature" (Hooker).
"Plants and Their Children" (Mrs. Wm. Starr Dana).
"Paul Bert's Science Series."

"Familiar Animals" (Monteith).
"Living Creatures" (Monteith).
"First Book in Chemistry" (Hooker).
Published by American Book Co., Chicago, Ill.
"Lessons in Botany" (MacBride).
Published by Allyn & Bacon, New York.
"Elements of Botany" (Bergen).
"Lessons in Astronomy" (Young).
Published by Ginn & Co., Boston, Mass.
"Plant Life" (Florence Bass).
"Animal Life" (Florence Bass).
Published by Heath & Co., New York.
"Healthful Living" (Ellen G. White).
"Principles of True Science" (Ellen G. White).
"The House We Live In" (Vesta J. Farnsworth).
"Parts of His Ways" (Cady). (In preparation.)
Pacific Press Publishing Co., Oakland, Cal.
Review and Herald Pub. Co., Battle Creek, Mich.
"Physics by Experiment" (Shaw).
Published by Maynard, Merrill & Co., New York.

A more complete list of reference books will be found in the latter part of this work.

USE OF REFERENCES.

At the close of each lesson reference will be made to such books as will aid parents and teachers in the preparation of the lesson. "Principles of True Science" and "Parts of His Ways" will be referred to most frequently. The former consists of a compilation from the "Spirit of Prophecy," bearing on science and Nature, while the latter is a descriptive work of five hundred pages, with an equal number of illustrations, treating all Nature in the light of God's plan in creation and redemption. The extracts in "Principles of True Science" can be readily found, as the topics are alphabetically arranged.

After each topic the source of reference will be given. To "Parts of His Ways" reference will be made by section and chapter where the desired information can be obtained. The chapter headings in "Bible-Nature Studies" correspond to the section titles in "Parts of His Ways," and the lessons to the chapters in the section. Reference to other books will be made by subject. "Parts of His Ways" is in preparation.

Introductory Lessons.

NOTE.—These introductory lessons are given, *first,* in order that teachers and pupils may catch, in the very beginning of their study, the true spirit and principles of Nature study as exemplified in the life of Christ, as a student and teacher.

LESSON I.

The Bible and Nature.

1. What is the Bible? By what other names is it called? *Ans.*—Holy Scriptures. 2 Tim. 3:15; John 5:39. Word of God. 1 Peter 1:23; Heb. 4:2.

2. Who gave the Bible to us, and by what means? 2 Peter 1:20, 21.

3. For what purpose did God give us the Bible? 2 Tim. 3:16, 17.

4. What is Nature? By what other names is it called? *Ans.*—The works of God. Ps. 40:5; 92:4, 5; 111:2; 139:14. God's handiwork. Ps. 19:1; 92:4.

5. Should we study Nature or God's works? Ps. 111:2, 4, 6; 143:5. Why? *Ans.*—To make us happy. Ps. 92:4. Reveals God's wisdom, power, and love. Rom. 11:33; Prov. 3:19, 20; Ps. 104:24.

6. Which is the older, the Bible or God's works?

7. Does the Bible have anything to say about Nature? Where and what? (Read the 104th psalm.)

8. Does Nature tell us about things which are found in the Bible?

9. What do you think of the plan of studying the Bible and Nature together?

10. Did Christ study Nature?

References.—"Principles of True Science:" Bible and Nature Studied by Christ, "Special Testimonies on Education," p. 64; Bible, the Foundation of Science, "Christian Education," p. 29; Bible Creates a Relish for Science, "Special Testimonies on Education," p. 220; Nature and Revelation Reveal God, "Patriarchs and Prophets," p. 598; "Christian Education," p. 65; Nature and Written Word, "Patriarchs and Prophets," p. 115; "Christian Education," p. 196; Nature's Operations Referred to in the Bible, *Review and Herald,* Nov. 8, 1898.

Suggestions to Teachers.—In this first lesson the parent or teacher is to show the pupils that the study of the Bible and Nature naturally go together. All should have Bibles, and bring them to each recitation. Help the pupils to realize that the Bible is what God has *spoken* to us, and that Nature is what God has *made* for us. The child should be taught that both Nature and revelation speak to us of our loving heavenly Father and of His care for all things that He has made. These early lessons of faith in the Word of God will prove as an anchor to the soul when in later years it is exposed to skepticism and infidelity. Ask the children to mention things in Nature which are spoken of in the Bible. Have some of these texts read. If they are slow about mentioning them, you can refer to some of them, such as the hen and chickens, cattle, horses, the ant, spider, sparrow, lily, fig tree, light, wind, sand, rocks, etc. After a few texts of this character have been read, you can ask the pupils to mention some common things with which they are acquainted, and then ascertain if the Bible speaks of them. If your recitation period is short, only a few texts can be read. Always aim to complete the lesson, the last thought being the one which leads up to the study of the next lesson. In this lesson your closing thought should be that they have had the first lesson in Nature study to-day, and now they want to know how to study Nature so that they may get the greatest benefit from it. Christ being our example in all things, in the next lesson they will learn the way in which Christ studied Nature when a child.

Study carefully the extracts found in the introduction under the topic, "The Bible and Nature."

LESSON II.

Christ as a Student of Nature.

1. What were the two great text-books studied by Christ? *Ans.*—The book of Nature and the Word of God. Sp. T. Ed., pp. 162, 64, 158.

2. Can you find anything in the Bible which shows that Jesus studied Nature? *Ans.*—The parables of the "Sower," "Wheat and Tares," "Grain of Mustard Seed," etc.

3. When did Jesus begin to study Nature? *Ans.*—When a child. Luke 2:40, 46, 47, 52. Sp. T. Ed., pp. 64, 158; D. A., pp. 70, 71, 90.

4. Did Jesus, when a child, know everything, or did He have to study as children now do? *Id.*

5. Did Jesus do any work? What trade did He learn? D. A., p. 72.

6. When and where did Christ study Nature? D. A., p. 90.

7. What other Bible characters can you mention who studied Nature? *Ans.*—Moses, Sp. T. Ed., p. 115; David, P. P., pp. 641, 642; C. E., pp. 204, 205; John the Baptist, Sp. T. Ed., p. 46.

8. Does the Lord want children and youth to study Nature now? Sp. T. Ed., pp. 62, 96, 97.

9. Who shall teach the children, and what text-book shall they study? T., vol. 3, p. 137; C. E., pp. 8, 9; Sp. T. Ed., p. 70.

10. What pattern shall the parents and teachers follow in teaching Nature to children and youth? *Ans.*—Christ, Sp. T. Ed., p. 67.

References.—"Principles of True Science:" Nature, Animate and Inanimate, Studied by Christ, "Special Testimonies on Education," p. 158; Nature and Bible Studied by Christ, "Special Testimonies on Education," pp. 64, 162; Nature, Christ as a Student of, "Special Testimonies on Education," pp. 158, 159; Nature as an Educator, "Patriarchs and Prophets," pp. 641, 642; "Christian Education," pp. 204, 205; Nature, Moses in School of, "Special Testimonies on Education," p. 115; Nature, the School of John the Baptist, "Desire of Ages," pp. 102, 103; Nature, the School of Christ, "Desire of Ages," pp. 70, 90, 419; Nature Only Text-book for Children, "Testimonies for the Church," vol. 3, p. 137; "Christian Education," p. 9; Nature the Child's Lesson-book, "Healthful Living," p. 151; Nature, Children Should Come Close to, "Special Testimonies on Education," p. 62; Nature Study Essential for Youth and Children, "Special Testimonies on Education," p. 60; Nature Study for Children, *Review and Herald,* Feb. 14, 1888; Nature's Lessons for Parents and Children, "Desire of Ages," p. 516.

Suggestions to Teachers.—In this second lesson the children will be much interested in learning that Christ, even when a child, loved to study the wonderful works of God. This is not stated directly in the

Bible, but is plainly inferred in the reading of the parables. This is also very plainly stated in the Testimonies above referred to, but some of your pupils may not believe the Testimonies are from God. Should this become manifest as you are proceeding with the lesson, I would read two texts, Rev. 12:17 and 19:10, showing that the spirit of prophecy or testimony of Jesus is to be manifested among God's remnant people. Cite the children to the fact that the Lord sent prophets to Israel, even though they did have the Word of God. Do not enter into a long discussion of this question; take only two or three minutes, and state that you will take up this question some day in the regular Bible class.

Study the home of Jesus in Nazareth, with its natural scenery, so that the children may see as clearly as possible His home life, with its privileges and opportunities. Endeavor to have the children realize that each one of them is in the world just as Jesus was. Jesus had to study in order to learn the truths of Nature and the Bible, but He was diligent, and kept His eyes open, observing the phenomena of Nature carefully and thoughtfully, that He might better understand the great wisdom, power, and love of His heavenly Father. The wisdom of Solomon may be referred to as evidence that God will impart wisdom to us if we seek it that we may glorify Him. God gave Solomon great wisdom in the study of all Nature. 1 Kings 3:5-15; 4:29-34. Study the quotations given in the introduction under the topic, "Christ as a Student of Nature."

LESSON III.

Christ as a Teacher of Nature.

1. What two great text-books did Christ study during His childhood and youth?

2. From what books did He teach? *Ans.*—The Scriptures. Luke 4:16-22; 24:27. Nature in parables. Matt. 13:34, 35.

3. What is the meaning of the word "parable"?

4. Mention several parables taught by Christ, as recorded in the four gospels, and give the Scripture references:—

(1) The parable of the sower and the seed, Matt. 13:3-9.

(2) The parable of the tares, Matt. 13:24-30.

(3) The parable of the grain of mustard seed, Matt. 13:31, 32.

(4) The parable of the leaven, Matt. 13:33.

(5) The parable of the hid treasure, Matt. 13:44.
(6) The parable of the pearl of great price, Matt. 13:45, 46.
(7) The parable of the net cast into the sea, Matt. 13:47-50.
(8) The parable of the vineyard, Matt. 21:33-41.
(9) The parable of the fig tree, Matt. 24:32-35.

5. Give the names of natural objects, with the Bible references, which are not used in parables but as symbols.

(1) The Light of the World, John 8:12.
(2) The Sun of Righteousness, Mal. 4:2.
(3) The Bright and Morning Star, Rev. 22:16.
(4) The Rock of Our Salvation, Ps. 89:26.
(5) The Salt of the Earth, Matt. 5:13.
(6) The Rose of Sharon, Songs of Sol. 2:1.
(7) The Lily of the Valley, *Id.*
(8) The Lamb of God, John 1:36.
(9) The True Light, John 1:9.
(10) The Bread of Life, John 6:48-51.
(11) The Fountain of Living Waters, Jer. 17:13.
(12) The Clay and the Potter, Jer. 18:1-6.

6. What is the meaning of the word "symbol"?

7. What is the advantage of teaching by parables and symbols? *Ans.*—The truth taught is illustrated by familiar objects, which are recognized by one or more of the five senses.

8. What was the one great object Christ had in studying and teaching Nature? *Ans.*—To learn and to reveal spiritual truth. Sp. T. Ed., pp. 64, 65, 158.

References.—"Principles of True Science:" Nature Used by Christ to Illustrate Divine Truth, *Youth's Instructor,* Sept. 14, 1899; Nature, Christ Taught from, "Steps to Christ," p. 96; "Christian Education," pp. 54, 142; Nature Used by Christ in Teaching, *Youth's Instructor,* May 6, 1897; Nature, Christ's Use of in Teaching, "Desire of Ages," p. 525; Parable of the Seed, "Christ's Object Lessons," p. 63; Tares and Wheat, "Testimonies for the Church," vol. 3, pp. 113, 114; "Testimonies for the Church," No. 32, p. 140; Vine and Branches,

Review and Herald, March 25, 1898; *Review and Herald*, December 13, 1887; Vine, Lessons Drawn from, "Desire of Ages," pp. 674-677; Sower, Parable of, "Special Testimonies on Education," pp. 68, 70; Fig Tree, Parable of, "Desire of Ages," p. 584; "Testimonies for the Church," No. 32, pp. 13, 108; *Review and Herald*, January 11, 1881; Light of the World, "Testimonies for the Church," vol. 1, p. 303; "Testimonies for the Church," No. 33, pp. 96, 107; "Desire of Ages," pp. 306, 307; "Testimonies for the Church," vol. 3, p. 248; "Testimonies for the Church," vol. 2, p. 633. See also Rock, Salt, Lily, and Star.

Suggestions to Teachers.—This lesson is designed more for the teacher than the pupil, for it is a study of Christ as a model teacher in the subject of Nature. This lesson is too long to present to the class, but should be thoroughly mastered by the teacher. Instead of giving all the parables and symbols mentioned in this lesson, give only a few of each, taking those most familiar to the children. These parables and symbols are not to be *studied* in the lesson, to discover what spiritual truth they teach, but are only referred to that the pupils may readily see that the Bible abounds with them, both in the Old and New Testaments. In the next lesson, Nature Teaches Spiritual Truth, you will draw out the spiritual lessons from some of the parables and symbols mentioned in this lesson. Study in the introduction the subjects, Christ as a Teacher of Nature, and Nature as an Educator.

LESSON IV.

Nature Teaches Spiritual Truth.

1. Why did Christ refer to Nature in His teaching? Sp. T. Ed., pp. 64, 65.

2. Does God call upon parents and teachers to-day, to teach spiritual truth through the objects of Nature? Sp. T. Ed., p. 97; T., vol. 3, p. 137; C. E., pp. 8, 9; T., vol. 2, pp. 582-585.

3. What enables us to understand the meaning of God's Word? 1 Cor. 2:10.

4. What will enable us to understand God's works? *Ans.*—The Holy Spirit. Sp. T. Ed., p. 59; *Y. I.*, May 6, 1897.

5. Which is the clearer revelation of God's character, His Word or His works? *R. H*, Nov. 8, 1898.

6. What portion of Nature is especially fruitful with material by which the kingdom of heaven may be illustrated? *Ans.*—The plant world.

7. Study carefully the following parables, and give the spiritual truths which they teach: Parable of the sower, the grain of mustard seed, leaven, wheat and tares, and the fig tree.

8. Study carefully the following symbols, and give the spiritual truths they teach: Rock of our Salvation, Sun of Righteousness, Light of the World, Fountain of Living Waters, Bread of Life, salt, and clay.

9. Will the study of Nature benefit us temporally as well as spiritually?

References.—"Principles of True Science:" Nature Teaches Obedience and Trust, "Steps to Christ," p. 97; "Patriarchs and Prophets," p. 594; "Christian Education," p. 60; Nature Reveals the Principles of Christ's Kingdom, *Youth's Instructor,* May 6, 1897; Nature, Spiritual Lessons to be Drawn from, *Review and Herald,* November 8, 1898; Nature Teaches the Mystery of Godliness, *Youth's Instructor,* May 6, 1897; Nature Reveals Momentous Truths, "Special Testimonies on Education," p. 64; Nature Teaches Self-sacrifice, "Desire of Ages," pp. 18, 19, 622, 623; Nature Teaches the Work of Grace, "Desire of Ages," pp. 191, 192; Nature Teaches the Most Exalted Spiritual Truths, "Testimonies for the Church," vol. 4, p. 579; Nature's Lessons Lost Sight of in Christ's Day, "Christ's Object Lessons," p. 18; Natural and Spiritual Truth Combined by Christ, "Special Testimonies on Education," p. 67; Natural Truths Illustrate Spiritual Truths, "Special Testimonies on Education," p. 64.

Suggestions to Teachers.—In the study of this lesson, take up as many of the parables and symbols as your time will allow. We have mentioned in this lesson those which should be taken up first. Make it plain to the pupils that Christ's great object in the study of Nature was to use it in a simple way to illustrate the wonderful truths of God's Word. Many study Nature merely to satisfy their curiosity, or to secure temporal gain, but not so with our Great Pattern. His constant desire was to learn ways of making truth so simple and easy to comprehend that even the ignorant and unlearned could grasp it. From this lesson, onward, encourage the children to gather the spiritual lessons from the surroundings of their daily life. Give opportunity at each recitation for the children to tell to the class the spiritual lessons they have gathered. Let the teacher inspire the pupils by taking the lead in this matter. The snow, rain, sunshine, frost, etc., are suggestive of grand and glorious truths found in the Word of God. Study the quotations in the introduction under the topic "Nature Teaches Spiritual Truth." In the next lesson, the many ways in which the study of Nature is beneficial, temporally and spiritually, will be considered.

LESSON V.

The Benefits of Nature Study.

1. What are some of the temporal benefits to be derived from the study of Nature? *Ans.*—Increased facilities for performing all kinds of labor.

2. Mention some of the inventions of scientists which make life more pleasant and labor more easy.

(1) Printing: Printing press.
(2) Traveling: Steam engine, electric motors.
(3) Farming: Reaper, mower, plow, etc.
(4) Communication: Telegraph, telephone.

3. What influence will the study of God's works have on the student, personally?

(1) It will make him observing.
(2) It will quiet and soothe the nerves. Sp. T. Ed., p. 61.
(3) It will refine and subdue the character. Sp. T. Ed., p. 46.
(4) It will awe the spirit. Sp. T. Ed., p. 159.
(5) It will invigorate the soul. *Id.*

4. What does the Word of God say about temporal and spiritual blessings? 2 Cor. 4:18.

5. Does the Lord want us to deny ourselves the common blessings of life?

6. How may we be sure of securing them? Matt. 6:28-34.

7. What, then, should be our desire in the study of God's created works? *Ans.*—To enjoy them as they minister to our temporal needs, recognizing them to be an expression of God's love and care; but, above all, to see in them an expression of truth, "a shadow of good things to come," even our eternal redemption.

References.—"Principles of True Science:" Nature's Influence on the Christian, "Testimonies for the Church," vol. 4, p. 297; Nature

Study Draws Minds of Frivolous Away from Low, Enervating Pleasures, *Youth's Instructor,* May 6, 1897; Nature, Softening and Subduing Influence of, "Special Testimonies on Education," p. 159; Nature a Living, Helpful Teacher, "Special Testimonies on Education," pp. 98, 99; Nature Study Good for Nervous Children, "Special Testimonies on Education," p. 61; Nature, Benefits of Communion with, "Desire of Ages," pp. 360, 361; Nature Furnishes Subjects for Deep Thought, "Testimonies for the Church," vol. 4, p. 581.

Suggestions to Teachers.—The previous lesson closes with the thought that the great object to be sought in the study of Nature is to be able to gather from it the spiritual truths with which it abounds. In this lesson we have indicated the temporal value of Nature's gifts and blessings. A few of the most common inventions have been given, but the teacher should feel free to exercise his judgment as to what to use and what not to use. The student should realize that the wonderful inventions of the present day are agencies which God has caused to be made, that the closing message of salvation may be carried to the world in a very short time. (Read "Special Testimonies on Education," p. 8; "Patriarchs and Prophets," p. 113; "Christian Education," p. 193.) This lesson concludes the study of the general principles underlying the proper study of the Word and works of God. Review these principles, and urge the pupils to carry on this study in accordance with these principles, so that from it they may derive the greatest benefit. The next five lessons take up the first two verses of the first chapter of Genesis, as an introduction to the study of the different steps of creation.

Chapter I.

THE EARTH IN THE BEGINNING.

(Scripture Basis, Gen. 1:1, 2.)

LESSON I.

Creator and Creation.

1. Did God and Christ create other worlds than the one on which we live? Heb. 1 : 2, last clause.

2. By what name do we commonly speak of the other worlds? *Ans.*—Stars.

3. Does God tell us in His Word that He created the stars, or the host of heaven? Gen. 1 : 16; Ps. 33 : 6; Isa. 40 : 26.

4. Did God create the sun and moon? Gen. 1 : 14-19; Ps. 136 : 7-9; 148 : 3-5.

5. Where in the Bible do we find the simple story of creation? *Ans.*—The first chapter of Genesis.

6. What three things do we learn in Gen. 1 : 1-3? *Ans.*—(1) The name of the Creator; (2) what He created; (3) when He created them.

7. How did God create the heaven and the earth? Ps. 33 : 6, 9.

8. When Christ was on earth, did He cause things to take place by simply speaking the word?

(1) He healed the centurion's servant. Matt. 8 : 5-13.
(2) He stilled the tempest. Verses 23-27.

9. Is creation a mystery which can not be solved by human wisdom? Sp. G., vol. 3, pp. 93-95.

10. What is necessary that we may understand how the worlds were framed? Heb. 11 : 3.

References.—"Principles of True Science:" Creation, Bible Contains the Only Authentic Record of, "Testimonies for the Church," No. 31, p. 21; "Christian Education," p. 38; Creator of the World Made Known in the Bible, "Special Testimonies on Education," p. 52; Creation a Mystery, "Spiritual Gifts," vol. 3, p. 93; "Patriarchs and Prophets," p. 113; "Christian Education," p. 193. "Parts of His Ways," section 1, chapter 1.

Suggestions to Teachers.—It is very important that the faith of the child be established in the Bible in early childhood. Your instruction should be of such a character as to lead the mind of the child to the Word of God to settle all difficult questions. When he is too young to read, the parent or teacher should read the answers to all questions directly from God's Word, first, instead of telling it in story form. The child should commit short passages, and learn to find them in the Bible. There is a power in the words of Scripture that is not found in a story. When the child grows to youth, and manhood, and meets the ideas of scoffers and infidels, these few scriptures that he has learned in his early years will come to his mind, and will prove an anchor to his soul. In this lesson, have the children learn the first verse of the Bible, "In the beginning God created the heaven and the earth;" also Ps. 33:9, "For He spake, and it was done; He commanded, and it stood fast." It may seem to some of the children that God did not create everything, for example, the stove, table, chairs, etc. Make plain the distinction between the word "make" and "create." It will be an interesting exercise to trace all these articles of furniture back to the Creator, showing that He created the material out of which they were made, and that they would not exist had He not created it.

LESSON II.

Upholding the Worlds.

1. Name all the things you can see, both indoors and out-of-doors.

2. Who made all of these things? Acts 17:24; Rev. 4:11; Isa. 66:1, 2.

3. Who was associated with God in the work of creation? *Ans.*—Christ, the Word. John 1:1-3; Col. 1:16, 17; Gen. 1:26.

4. What would we know of creation had we not the Bible? *Ans.*—Nothing. Job 38:4-38.

5. What upholds the sun, moon, and stars, so that they do not fall or dash against one another? Heb. 1:3; Ps. 33:9; Isa. 40:26.

6. Does the power of God uphold the earth upon which we live, or is it hanging upon something? Job 26:7.

7. What ideas have the heathen had as to what upholds our world? *Ans.*—Some thought it was borne upon the shoulders of their god Atlas; others said that it was supported upon the backs of twelve elephants, which stood upon a huge turtle; and still others believed it was carried in the hands of the gods as they would fly through the heavens.

8. Why did they have such foolish ideas? Rom. 1:20-22.

9. Is God working now? *Ans.*—"The God of heaven is constantly at work." (Read C. E., p. 195.) John 5:17.

10. What is He doing? *Ans.*—Upholding the things He has made. Heb. 1:3.

References.—"Principles of True Science:" Creation Upheld by God's Power, "Patriarchs and Prophets," p. 114; "Christian Education," p. 195; Creative Energy Made and Upholds the World, "Special Testimonies on Education," p. 58; Universe Upheld by Creative Energy, *Id.*; Worlds Upheld by God's Power, "Testimonies for the Church," vol. 4, pp. 415, 416; Nature Superintended as Well as Created by God, *Review and Herald,* November 8, 1898. "Parts of His Ways," section 1, chapter 2.

Suggestions to Teachers.—The central thought in this lesson is that God, who created all things, is now exercising His power in upholding them. The reason why the earth rotates on its axis, why the sun rises and sets, why seasons recur in regular order, and that all vegetation flourishes, is because the Creator is continually exercising His power in sustaining them. God did not wind up the universe as one would wind up a clock, and then go away and think no more about it, but daily, hourly, momentarily, His care is over all; so that not even a sparrow can fall to the ground without His notice. Every hair of our head is numbered. This is a wonderful lesson, and one that will be of great value if learned in childhood. The thought of God's continual presence and power everywhere about the child, and in him, will make him fear to sin, and keep him from yielding to many a temptation. Moses endured as seeing Him who is invisible. How God is all-seeing and everywhere present to sustain His vast creation is a great mystery, and can be understood only by faith in His Word. The next lesson will show the condition of our world when it was first created. Have the children commit part of Heb. 1:3, "Upholding all things by the word of His power."

LESSON III.

The Earth in the Beginning.

1. How was the world brought into existence? Ps. 33:6, 9.

2. What was the condition of the earth when God first created it? Gen. 1:2. *Ans.*—

(1) It was without form.
(2) It was void.
(3) It was covered with water.
(4) It was enshrouded in darkness.
(5) The Spirit of God brooded over the waters.

3. What is the meaning of "without form," and "void"? Compare a ball or a cube block with an irregular stone.

4. What is the only substance mentioned in Gen. 1:2? *Ans.*—Water.

5. Was the entire earth composed of water? Gen. 1:9, 10. *Ans.*—It was composed of land and water.

6. Out of what was the land and water made? Heb. 11:3. *Ans.*—Nothing.

7. What was brooding upon the face of the water? *Ans.*—The Spirit of God.

8. Why was the Spirit of God present? *Ans.*—To execute the will of God,—to bring order out of chaos. Matt. 12:28.

9. Why does the Spirit of God come into our hearts? *Ans.*—To execute the will of God,—to bring peace and harmony where there are strife and confusion.

References.—"Principles of True Science:" Matter Created by God in the Beginning, *Signs of the Times,* 1884, No. 11. "Parts of His Ways," section 1, chapter 3.

Suggestions to Teachers.—The earth, as it came forth from the hand of the Creator, was composed of but two substances,—land and water,—solid and liquid. The earth was a shapeless, formless mass of matter enveloped in darkness. The land was completely covered with water. You can illustrate the chaotic condition of the earth by bringing before the minds of the pupils the conditions which

exist when the carpenter is building a house. The lumber, timbers, stone, brick, sand, etc., are placed in piles around the spot where the house is to be erected. Everything seems to be brought together and placed about in a disorderly way. It does not look as though anything beautiful and symmetrical could come out of this collection of crude, raw materials, but the skilled carpenter will work upon them and make a grand and beautiful structure. So, also, the Spirit of God was present to take what God had created, although "without form" and "void," and fashion it into the beautiful temple of Nature. The next lesson will develop the reasons God had for creating this earth. Have the children commit to memory Gen. 1:2.

LESSON IV.

Why God Created the Earth.

1. When a carpenter builds a house, has he a good object in view? What is it?

2. When God created this world, did He do it just to show His great wisdom and power?

3. What was His purpose? *Ans.*—He formed it to be inhabited. Isa. 45:18. To receive pleasure. Rev. 4:11; Prov. 16:4.

4. What prompted God to create the earth, and to people it with intelligent beings? *Ans.*—Love.

5. What is God? 1 John 4:8, 16.

6. Had God created other worlds and peopled them before He created ours? Job 38:7.

7. What should the great love of God toward us cause us to do? *Ans.*—To love Him in return. 1 John 4:19.

8. Could the love of God be satisfied to leave the world in the unfinished condition mentioned in Gen. 1:2, 3?

9. If we have the love of God in us, can we be satisfied when we see darkness reigning in the hearts of others?

References.—"Principles of True Science:" Nature Speaks of God's Love, "Mount of Blessing," p. 137; Nature to be Enjoyed, *Review and Herald,* Oct. 11, 1887; Natural Objects Bear the Impress of the Deity, "Patriarchs and Prophets," pp. 599. 600; "Christian Education," p. 67. "Parts of His Ways," section 1, chapter 4.

Suggestions to Teachers.—Carry out the illustration of building a house, and show that the carpenter builds it that some one may live in it and enjoy its blessings. It is the father's love which causes it to be built, knowing that He will find great delight and pleasure in seeing the children enjoy their new and pleasant home. So God, our Father, had Christ, His Son, through the direct working of the Spirit of God, build this world that He might provide a home for His children. It was God's great love which prompted Him to do this; and His greatest delight and pleasure are to see His children enjoying the beautiful home He has prepared for them. Have the children commit part of Isa. 45:18, "He created it not in vain, He formed it to be inhabited;" also part of Rev. 4:11, "For Thou hast created all things, and for Thy pleasure they are and were created." If the pupils are old enough, have the entire verses committed. In this lesson it is seen that God created the world that it might be inhabited, and this prepares the way for the next lesson, which gives the steps taken to change it from a chaotic condition to a beautiful home for man.

LESSON V.

The Earth Beautiful.

1. For whom did the Lord make the earth? *Ans.*—For man. Ps. 115:16.

2. Did the Lord make the chaotic earth into a beautiful home?

3. How much time did the Lord take to do this? *Ans.*—Six days.

4. Mention what the Lord did on each of the six days? —*Ans.*

(1) The first day He made light. Gen. 1:3-5.

(2) The second day He made the firmament. Gen. 1:6-8.

(3) The third day He made the dry land, seas, and plants. Gen. 1:9-13.

(4) The fourth day He made the sun, moon, and stars. Gen. 1:14-19.

(5) The fifth day He made the water animals and air animals. Gen. 1:20-25.

(6) The sixth day He made the land animals and man. Gen. 1:26-28.

5. Which is the most wonderful of these creations? *Ans.*—Man. Ps. 139:14.

6. What place did the Lord make especially beautiful and pleasant for Adam and Eve? *Ans.*—The garden of Eden. Gen. 2:8-17.

7. What is the study of these things mentioned in the first chapter of Genesis called. *Ans.*—The study of Nature.

8. Are these the things which Christ studied? Sp. T. Ed., p. 158.

9. Did Adam and Eve study them? P. P., pp. 50, 51; C. E., p. 207.

10. What shall we study first? *Ans.*—The first thing created,—light.

References.—"Principles of True Science:" Nature's Beauty and Its Purpose, "Mount of Blessings," p. 138; Nature Rejoices in God, *Review and Herald*, Feb. 14, 1888; Nature, a Description of, "Testimonies for the Church," No. 32, p. 68; Nature's Blessings to Awaken Gratitude, *Id.;* Nature the Lesson Book of Our First Parents, Review and Herald, Nov. 8, 1898. "Parts of His Ways," section 1, chapter 5.

Suggestions to Teachers.—In this lesson the teacher will take a hasty survey of the first chapter of Genesis, so that the pupils may see what the Lord made in the six days of creation, that were designed to contribute to man's happiness. As they name over these things, have them see how necessary they are to our every-day happiness. We could not live if we were deprived of light, heat, air, water, and food. How pleasant it is to hear the sweet music of the birds, and to see the animals as they enjoy their fun and frolic! The lessons from now on will be a careful study of all Nature, in the order of creation, as related to man,—the masterpiece of God's creation. There will be fifteen lessons on Light and Heat.

Chapter II.

LIGHT AND HEAT.

(Scripture Basis, Gen. 1:3-5.)

LESSON I.

The Creation of Light.

1. Who created light? Gen. 1:3.
2. How did God create it? *Id.*
3. When was light created? Gen. 1:5.
4. What is the opposite of light? *Ans.*—Darkness.
5. What did God call the light? Gen. 1:5. *Ans.*—Day.
6. What name did He give to darkness? *Id.* *Ans.*—Night.
7. What other names are given to light and darkness? Gen. 1:5. *Ans.*—Evening and morning.
8. What was one of God's purposes in creating light? *Ans.*—To measure off the day.
9. What measures the day now? *Ans.*—The light of the sun.
10. How long is the day now? How long were the days of creation week? P. P., pp. 111, 112; C. E., p. 190; Sp. G., vol. 3, p. 90.
11. How many different kinds of light are mentioned in the Bible?

References.—"Principles of True Science:" See Light. "Parts of His Ways," section 2, chapter 1.

Suggestions to Teachers.—The first thing the child should learn in studying light, air, water, etc., is that God made them. Then he will realize that all things belong to God, and that they reveal His power, wisdom, and love. In this lesson do not teach the pupil that

light was made on the first day in order that we might see, for it was several days before Adam and Eve were created, that light was spoken into existence. Light serves many purposes, and these will be brought out at the proper time. In this lesson teach that the days of creation week were twenty-four hours long, just as now, and that light measured off the days, as at the present time. Light was brought into existence by the word of God, just as were the heaven and the earth, spoken of in Gen. 1:1. Have the pupil commit to memory Gen. 1:3. Close this lesson by asking the children to look up all the different kinds of light mentioned in the Bible. Never close a lesson without giving something to occupy the mind, and, when it is possible, both the mind and the hand, until the next recitation. Give out something that will cause the pupil to look forward to the coming recitation with interest.

LESSON II.

Natural and Spiritual Light.

1. Give a list of the different lights spoken of in the Bible.
   (1) The light of the sun. Gen. 1:14-19; Ps. 136:6-9.
   (2) The light of the moon. Gen. 1:14-19; Ps. 136:6-9.
   (3) The light of the stars. Gen. 1:14-19; Ps. 136:6-9.
   (4) The Word of God is a light. Ps. 119:105.
   (5) Prophecy is a light. 2 Peter 1:19.
   (6) The light of the gospel. 2 Cor. 4:4.
   (7) God is light. 1 John 1:5.
   (8) Christ is the Light of the world. John 8:12.
   (9) Christians are the light of the world. Matt. 5:14.
2. Who is the author of all these lights? James 1:17.
3. In what does God dwell? 1 Tim. 6:16.
4. Give a Bible definition of light. Eph. 5:13.
5. Does it correctly define all the different lights above mentioned?
6. Why was Christ a light in the world? *Ans.*—He manifested His Father. John 17:6; 1 Tim. 3:16.

7. Why are Christians lights in the world? *Ans.*—They manifest their heavenly Father. Matt. 5:16.

8. How do we see the light of the sun? *Ans.*—With the physical eye.

9. How do we discern the light of God's Word? *Ans.*—With the eye of faith. Eph. 1:18.

10. In the Bible, what do light and darkness represent? *Ans.*—Righteousness and unrighteousness. John 3:19-21.

11. What is the relation between natural and spiritual light?

(1) Adam and Eve clothed in light. Sp. G., vol. 3, p. 43.

(2) Moses' face beamed with light. Ex. 34:33-35.

(3) Stephen's face shone as that of an angel. Acts 6:15.

(4) Christians will wear a bright beaming countenance. Isa. 60:1, 2.

12. What has light to do with color?

References.—"Principles of True Science:" Light a Symbol of God's Presence, "Desire of Ages," pp. 463, 465. "Parts of His Ways," section 2, chapter 2.

Suggestions to Teachers.—This is a long lesson, and should be thoroughly studied by the teacher. Select from it that which the pupils can readily grasp in the time of the recitation. Make it plain that the God who gave us the light of His Word is the God who gives the light of the sun, moon, and stars. The light of the sun, moon, and stars is seen by the physical eye, while the light of the Word is seen by the eye of faith, as it is received into the mind. In the Scriptures, physical light represents righteousness, while darkness represents unrighteousness. Christ is the Light of the world, while Satan is the prince of darkness. All who are loyal to Christ are bodies of light, because they are righteous, while those who are loyal to Satan are bodies of darkness, because they are full of sin and iniquity. The work of Christ is to reveal God's character, while the work of Satan is to cover it up. If we are righteous, pure in our thoughts, our countenance will beam with holy joy; but if we are sinful, cherishing evil thoughts and desires, we will show it in our faces, too; and we will not be open and frank, willing to have others see our actions, but will try to cover up and conceal the evil.

LESSON III.

The Colors of Light.

1. What is the color of light? Matt. 17:2.

2. If a ray of light be passed through a prism, what takes place? *Ans.*—It is separated into seven different parts.

3. How is this indicated? *Ans.*—By the color of each part.

4. Name the different colored threads which compose a single ray of light. *Ans.*—Violet, indigo, blue, green, yellow, orange, and red.

5. What is the shape of a prism? Of what is it composed? Draw it.

6. What direction does light take when it enters a dark room?

7. When it enters the prism does it change its course?

8. When it leaves the prism does it take the same direction it did before entering?

9. Draw the prism, and a ray of light from the time it enters the room until it shows the beautiful prismatic colors which fall on the wall or screen.

10. What have you seen that looks like the light after it has passed through a prism? *Ans.*—A rainbow.

11. What causes the rainbow? *Ans.*—The rain-drops are little prisms, which separate the rays of light into their different colors.

12. Of what is the rainbow a token? *Ans.*—Of God's love. Sp. G., vol. 3, pp. 73, 75; T., No. 33, p. 279.

13. When the light of the gospel shines into the heart-prism, what is the result? *Ans.*—The beautifully-colored fruits of the Spirit are manifested. Gal. 5:22, 23.

14. What causes objects to have different colors?

References.—"Principles of True Science:" Rainbow, a Covenant of Promise, "Spiritual Gifts," vol. 3, pp. 73-75; Rainbow Encircling

God's Throne, "Testimonies for the Church," No. 33, p. 279; Nature Manifests God's Glory, *Review and Herald,* July 11, 1882; "Parts of His Ways," section 2, chapter 4. Physics, see Color. Where the terms "physics," "chemistry," "botany," "astronomy," "zoology," etc., are used, it is designed that the teacher shall refer to any elementary text-book on these subjects that he may possess. The teachers need these books not only for their own use, but also as reference books for the pupils. Besides these books, two or three general science books will be found very helpful to both teachers and pupils. The following are recommended: "First Steps in Scientific Knowledge," and "Primer of Scientific Knowledge," by Paul Bert, published by J. B. Lippincott Company, Philadelphia. Also, the "Child's Book of Nature," by Hooker, published by the American Book Company.

Suggestions to Teachers.—To secure the best results in the teaching of this lesson, a room should be darkened, and a small pencil of light should be admitted through a crack, or small opening. Blankets or comforters may be used to darken the windows. A prism may usually be obtained at a store where toys are kept, but if not, you may find one in the trimmings of a hanging-lamp. Any square-cornered bottle filled with water will make a fair prism. Right here let me say that the teacher should study to devise every means possible to illustrate these lessons. Appeal to the eye as well as to the ear. As the experiments are being performed, do not tell anything that you can get the student to tell you by asking him questions. When the experiment is fully understood, the student should make a drawing representing the apparatus and the phenomena produced by it. Have the students draw everything they study, for this will impress it upon the mind.

LESSON IV.

How Different Colors Are Made.

1. Take a reading-glass, and place it in the path of a ray of light after it has been separated by the prism.

2. What becomes of the separate threads of the ray, and the seven colors? *Ans.*—The threads are brought together again, and the ray appears white, as it does before entering the prism.

3. What do we learn from the above experiments with the prism and reading-glass? *Ans.*—That the light of the

sun is composed of seven different colors, which can be separated and brought together again.

4. The color of light being white, by what means, then, is white produced? *Ans.*—By the mingling of the seven prismatic colors.

5. Make a buzz, and paint the disk with the seven prismatic colors (using water colors), and see if the disk will appear white when rotating rapidly.

6. Paint a disk one-third yellow and two-thirds blue. Rotate rapidly. What color is produced? *Ans.*—White, or gray if the colors are not pure.

7. Divide a disk into three equal parts, painting them green, red, and violet. What color is produced? *Ans.*—White. What do green and red produce? *Ans.*—Purple.

8. What is the color of the light coming through a window-glass. *Ans.*—White. Why? *Ans.*—All the seven colors pass through the glass to the eye.

9. Why does light coming through a blue glass appear blue? *Ans.*—Because the glass will only let the blue part of the ray pass to the eye. This is equally true with green glass, red glass, etc.

10. Why does a house look white? *Ans.*—Because the light does not pass through the surface of the building, but is reflected to the eye. The nature of the paint is such that the seven colors are reflected, so the house appears white.

11. When would a house look green? Yellow? Blue?

12. What causes an object to look black? *Ans.*—The seven colors are absorbed, none of them being reflected to the eye.

13. Would there be any color if there was no light?

14. What was the Creator's purpose in making color?

References.—"Parts of His Ways," section 2, chapter 4.

Suggestions to Teachers.—This will be an interesting lesson, for it will explain many things of a practical nature. Have the students make the different-colored disks and whirl them with a top, or buzz. This is a good time to introduce water colors, and have the pupils use them in their drawing work. The color of a flower, or

leaf, or whatever it may be, depends upon how the object treats the light. In some cases it reflects all of it; then the object is white. Sometimes it receives all the light, and keeps it; then it is black. If we absorb all the light, then we are bodies of darkness; if we reflect it, then we are bodies of light. Read the chapters on Color in Hooker's "Child's Book of Nature."

LESSON V.

The Looking-Glass.

1. What is a looking-glass?

2. Out of what materials is it made? *Ans.*—Glass and quicksilver.

3. For what purpose is it used?

4. Why not use a pane of window-glass?

5. Why is a coat of quicksilver painted on the back of the looking-glass? *Ans.*—Because it will reflect all the light. It will not allow the light to pass through it, neither will it absorb the light.

6. Use other materials, such as different-colored paper and cloth, and see if they make a good looking-glass.

7. What is the difficulty with the cloth and paper? *Ans.*—They absorb, or allow more or less light to pass through them, thus they are not good reflectors.

8. How do we see ourselves in a looking-glass? *Ans.*—The light shines upon our body, then passes from our body to the looking-glass; the quicksilver stops the light, and reflects it back to the eye.

9. What substances are the best reflectors? *Ans.*—Metals.

10. What kind of light does the moon give to the earth? *Ans.*—Reflected light.

11. What other heavenly bodies shine with reflected light? *Ans.*—The planets.

12. From what source do the moon and the planets receive their light? *Ans.*—From the sun.

13. Do Christians shine with their own light or with reflected light?

14. From what source do they receive their light? *Ans.*—Christ, the Sun of Righteousness.

References.—"Principles of True Science:" Nature as a Mirror, "Special Testimonies on Education," p. 59. "Parts of His Ways," section 2, chapter 5. Physics, see Reflection of Light.

Suggestions to Teachers.—"The same principles run through the spiritual and the natural world." Sp. T. Ed., p. 216. In the study of the looking-glass we have brought out the principle of the reflection of light. According to the above statement, this principle runs through the spiritual as well as the natural world. In all your study, constantly look for the spiritual lessons; for they are of more value than the lessons of Nature alone. Have your materials for illustration in readiness before the recitation begins, so as to avoid any confusion. All that you will need is a looking-glass. It would be better to have three or four, so that you may reflect the light several times, from one mirror to another. The best results will be secured if this work be done in a dark room, for then the beam of light can be seen much more distinctly. Sprinkle a little chalk dust in the path of the light if the room is not very dark. To illustrate how the light strikes the glass and is reflected, roll or throw a ball against the wall and see it bound back. You can show the angle of reflection (the angle at which the ball strikes the wall) and the angle of incidence (the angle at which it bounds back) with the use of the ball. The principle of reflection is nicely illustrated, also, by the light of the moon, which is borrowed from the sun. Christ, the Sun of Righteousness, shines upon us, and then we, like the moon, reflect to the world lying in the darkness of sin. This is a wonderful lesson; pray for the Spirit's presence to impress it upon the young minds.

LESSON VI.

God's Looking-Glass.

1. Has God a looking-glass into which we should look? *Ans.*—Yes.

2. What is the name of God's mirror? *Ans.*—The law of God. James 1:23-25.

3. What do we see as we look into this looking-glass, God's law? *Ans.*—The glory, or character, of God. 2 Cor. 3:18.

4. What else does it reveal? *Ans.*—The sins and stains of our characters.

5. When an ordinary looking-glass reveals dirt and stains on our person, what do we do? *Ans.*—We remove them by washing with water.

6. When God's looking-glass reveals the stains of sin in our characters, what should we do? *Ans.*—Have them washed away by the blood of Christ. Ps. 51:2, 7; Acts 22:16; Rev. 1:5.

7. When the stains of sin are washed away, what do we become? *Ans.*—Reflectors of light. Matt. 5:14.

8. Where does our light come from? *Ans.*—Christ. John 8:12.

9. From whom did Christ receive His light? *Ans.*—From God.

10. When we look at Christ, whom do we see? *Ans.*—God. John 14:5-10.

11. When others look at us, whom will they see? *Ans.*—God.

12. What do we become when Christ has washed away all our sins? *Ans.*—We become looking-glasses, or reflectors, into which people may look and see God and Christ.

Reference.—"Parts of His Ways," section 2, chapter 6.

Suggestions to Teachers.—After the lesson on "The Looking-glass" has been given, this lesson on "God's Looking-glass" will come in very appropriately. The law of God is a mirror into which we look, not to see our faces, but to see the defects of our character and the righteousness of God's character. If we look in, and then go away, not having the defects removed, we are as foolish as a man would be who looks into a glass and finds his garments soiled, his hands and face covered with dirt, and yet takes no pains to effect a change in his appearance. Whenever we read the Bible, we are looking into God's great mirror. Whenever we study His handiwork, we are looking into the mirror of Nature, which reflects the great goodness and love of our kind heavenly Father. As we see God's character reflected from the face of Nature, it should lead us to become godlike in our ways and thoughts. Each lesson should impress more vividly upon the student's mind the power, the wisdom, and the love of God. The pupil should see in each study both temporal and spiritual blessings. The great variety of colors pleases

the eye and enables us to distinguish objects. The reflection of light by nearly all the objects in Nature makes them more plainly visible. Each object does something to make others more distinct, by reflecting its little light upon them. This should teach us the lesson of mutual helpfulness in bearing the burdens of life.

LESSON VII.

Bending of Light Rays.

1. In what direction does light travel? *Ans.*—In straight lines.

2. What influence does the prism have upon the light? *Ans.*—It causes the ray to bend at the point where it enters the prism.

3. What other common substance causes the rays of light to bend? *Ans.*—Water.

4. In what way can you prove that water bends the rays of light? *Ans.*—The fence-post standing in the water appears bent or broken. Place a pencil or pointer in a dish of water, and it appears broken at the water's surface. Draw.

5. Place a silver coin on the bottom of a tin or wooden vessel. Take a position so that the coin will be concealed by the edge of the vessel. Have some one slowly pour water into the vessel. What happens to the coin? Why not have used a glass vessel?

6. How can you prove that the fence-post, pencil, and pointer are not broken? *Ans.*—By taking them out of the water and examining them.

7. What makes the objects appear bent? *Ans.*—The bent rays of light which come to the eye.

8. Does light travel from the eye to the object, or from the object to the eye? *Ans.*—The object gives off, or reflects, the light, and the eye receives it.

9. Try to touch a small object in a pond of water with a pole. Why do you not touch it? *Ans.*—Because it is not where it appears to be.

10. Where is the object? *Ans.*—It is a little nearer to you than it appears to be, because the rays passing up through the water bend right at the surface, and then pass on straight to the eye.

11. Why does the object appear farther away? *Ans.*—Because apparently you look in a straight line, while the rays of light are actually bent.

12. What have we learned about the traveling of light in the study of the prism, and of the object under water? *Ans.*—(1) In the same substance or medium of uniform density, light travels in a straight line; (2) light, passing from one substance into another having different densities (as from air into glass, and water into air, and *vice versa*), is bent where their surfaces meet.

13. Make a drawing showing a ray of light reflected from an object under the water to your eye.

References.—"Parts of His Ways," section 2, chapter 7: Physics, see Refraction of Light.

Suggestions to Teachers.—This is a difficult lesson for children to comprehend, and needs to be thoroughly understood by the teacher. If it did not lie at the foundation of many common things which we see in life, it might be omitted. But the magnifying glass that the pupils will use in the study of insects, rocks, flowers, etc., and also the eye, is constructed in accordance with this principle of refraction of light. This recitation should begin by referring back to the prism. If you can, take the pupils out where there is a pond of water, and let them with a pole try to touch some small object in the water. Let them notice how an upright stick appears broken at the water's surface. When outdoor circumstances are not favorable, they may use a pointer or a pencil in a pan of water. It is better to use a glass dish if you can secure one. If you have a dark room and let the light fall upon the water in a glass dish, you will see that the ray passing through the water is not in a straight line with the part that is in the air. If you can get two prisms, and place their bases together, you will notice that the rays of light passing through the double prism are converged. These points being all understood, your pupils are now ready for the application of the principle of refraction in a practial way. Let the pupils make drawings of a boy sitting on the bank, and wondering why the fence-

post appears bent in the water. The pupils should represent the rays coming from the post to the surface of the water, then bending and passing on to the eye of the observer.

LESSON VIII.

The Magnifying Glass.

1. Get two watch crystals, and place their hollow surfaces together. Let the light shine through the crystals. What is the result? Let the light shine through one of the lenses of a pair of spectacles.

2. Why does the light appear brighter, and what causes it to be concentrated into one small spot? *Ans.*—The watch crystals and the lens of the spectacles bend the rays so that they come nearer together.

3. Look at a fly, or some small object, through the watch crystals. What change takes place? *Ans.*—The object appears larger than before. Why do the fish in a round aquarium appear larger when looking at them from the side than from the top?

4. Look at the same objects through a bottle or flask filled with water, and give the result.

5. Look through a magnifying glass, and notice how much larger objects appear.

6. What makes them appear larger? *Ans.*—The magnifying glass has a piece of glass shaped like the watch crystals when placed together, and this bends the rays that come from the body of the fly to our eye; but as we look in straight lines, we see the image of the fly where there is no fly, just as we saw the object under the water where it was not.

7. What instruments contain magnifying lenses? and of what practical use are they? *Ans.*—The microscope and the telescope. Were it not for the microscope, we would not know of the little germs of disease which produce sickness and

death. It reveals to us also the wonderful little plants and animals which can not be seen with the naked eye. The telescope reveals to us the wonders of the heavenly bodies,—the sun, moon, planets, and millions of stars which would never have been known had not the telescope been invented.

8. Who invented the telescope? *Ans.*—Galileo, in the sixteenth century, made the first crude telescope out of a piece of lead pipe, by placing a glass lens in each end. With this he discovered the four moons of Jupiter.

9. Make a drawing showing the light passing from the fly's body, through the lens, to the eye, and showing the magnified image of the fly.

10. What great magnifying glass is spoken of in the Word of God? Isa. 42:21.

11. What does this reveal to men? *Ans.*—The wonderful character of God.

References.—"Parts of His Ways," section 2, chapter 8. Physics, see Lenses, Microscope, and Telescope.

Suggestions to Teachers.—You will notice that the watch crystals with their hollow surfaces put together, look somewhat like the two prisms with their bases placed together, the outer surfaces of the crystals being rounding, while the faces of the prisms are flat. Draw a curved line which will touch the four points of the prisms, and you will have an outline which very much resembles the appearance of the watch crystals. Now have the pupils look through a flask filled with water, then through the lens of a common magnifying glass, at some small object. The rays of light, by the double prism, or lens, are focused to one point, and the eye, following the rays back in apparently straight lines, produces an enlarged image of the object. Have the pupils draw the magnifying-glass lens, with the fly and its enlarged image. This principle of magnification being understood, then read Isa. 42:21. Christ is the great Magnifying Glass, through which we may look and get enlarged and exalted views of the character of God. The world owes much to the discoveries that have been made with the microscope and telescope, but it owes everything to Christ, the Great Magnifier, through whom have some such wonderful revelations of God. The next lesson will introduce the subject of Heat.

LESSON IX.

The Companion of Light.

1. Place your hand in the direct rays of the sun. What do you feel?

2. Is heat always connected with the light of the sun?

3. How can you prove this? *Ans.*—Take a lamp reflector, and hold it so that the sun's rays will strike the concave side. Place your hand where the rays are focused. Place some paper and cloth at the same point, and notice the results.

4. In the above experiment what did you notice about heat that is similar to light? *Ans.*—Heat is reflected.

5. Does heat, like light, travel in straight lines? *Ans.*—Yes. Prove it.

6. In what respect are light and heat different? *Ans.*—Light is visible, while heat is invisible.

7. How do they differ in their effects? *Ans.*—Light gives sight, while heat gives warmth.

8. What effect does heat have upon an object? *Ans.*—It expands it. Illustrate.

9. What is the opposite of heat? *Ans.*—Cold.

10. How does cold affect an object? *Ans.*—It contracts it. Illustrate.

11. What instrument is used to measure heat? Describe the readings of Fahrenheit and Centigrade thermometers.

12. What does light symbolize in the Bible? *Ans.*—Righteousness.

13. What does heat symbolize. *Ans.*—Zeal. Rev. 3:15-19.

14. Since light and heat are found together in the natural world, will not righteousness and zeal be associated together in the spiritual world?

15. What two elements, then, will be manifested in the life of a Christian? *Ans.*—Righteousness and earnestness.

References.—"Parts of His Ways," section 2, chapter 9. Physics, see Heat.

Suggestions to Teachers.—The subject Heat is naturally introduced by the experiment with the lamp reflector. This is the proper time to study heat, and note in what respects it is similar to, and in what respects it differs from, light. It being associated with light, it is certain that these forms of energy,—the power of God,—will work harmoniously together. God does not make things to work against each other, but rather to work together to accomplish the work He designed them to do. Here is a lesson for us. There should be unity among men as well as among things. There should be unity between God and man. "We are laborers *together* with God." Light travels in straight lines; so also does heat. Light is reflected; so also is heat. Heat always accompanies the sunlight; so also is zeal, spiritual heat, always found in the heart which is illuminated by the Sun of Righteousness. The next lesson will show the different ways in which heat is a blessing.

LESSON X.

How Heat Travels.

1. Will light pass through all substances?

2. When it does pass through a substance, what is said of it? *Ans.*—When all the rays pass through, it is called transparent, as in the case of glass. When some of the light passes through, as in the case of alum, it is called translucent.

3. Does heat pass through all substances? *Ans.*—Yes, but through some more rapidly than others.

4. Place iron, copper, lead, zinc, brass, and tin wires in a lamp flame. These should be of the same length, and all placed in the flame at the same time. These wires may be stapled on a board so that all the ends to be placed in the flame may come together.

5. Feel the wires with the fingers, and see through which the heat is traveling the most rapidly.

6. What do you say of the wires which allowed the heat to pass through them rapidly? *Ans.*—They are good conductors.

7. What do you say of the other wires? *Ans.*—They are poor conductors.

8. Try other substances, wood, glass, water, etc., and make a list of good and poor conductors.

9. Is a stove made of material that is a good conductor? Why?

10. Are the cooking utensils made of good or poor conducting substances? Why?

11. Why are the handles of flat-irons, coffee-pots, tea-kettles, and stove-pokers made of wood or glass?

12. Why do we wear cotton clothing in summer and woolen in winter? Which is the best conductor of heat? Why?

13. Can you answer the question which Elihu asked Job thousands of years ago? Job 37:17.

References.—"Parts of His Ways," section 2, chapter 10. Physics, see Heat Conduction.

Suggestions to Teachers.—Heat will penetrate objects, and increase their size, but not their weight. The heat causes the little particles (molecules) to separate farther apart, so that a bar of iron is longer when it is heated than when it is cold. For this reason the ends of the iron rails used in building a railroad track, are not placed close together. Heat is a wonderful force, which is absolutely essential to our convenience and comfort. Different substances treat heat differently. Some will allow the heat to pass through them freely, while others will not. Our stoves are made of iron because it allows the heat within to pass through it and thus make our houses warm in winter. Our bodies may be compared to stoves, the air and food answering to the fuel. In the summer, the weather being warm, we wear cotton clothing, which lets the heat of the body pass out readily. But in winter we need to retain the heat, therefore we wear woolen, which imprisons the air in the little spaces in the fiber. Air is a very poor conductor of heat, hence it does not let the heat escape, and thus the body is kept warm. The body should be kept at a certain temperature, 98.4 degrees Fahrenheit. In order that this temperature may be maintained, we wear such clothing, and such an amount of it, as will protect the body from the sudden changes of weather. We add quilts and covering to our beds in winter, not to keep the cold out, but to keep the heat in.

LESSON XI.

What Is Fire?

1. What was produced when the heat of the sun's rays was focused by the lamp reflector upon the cloth and paper? *Ans.*—Fire, or combustion.

2. Give an artificial method of producing heat. *Ans.*—By friction.

3. Give some experiments that will prove this. *Ans.*—Rub two sticks together. Saw a stick of wood, then feel of the saw. Strike an anvil several times in quick succession.

4. What is the result produced by the above experiments? *Ans.*—Heat is generated.

5. If the friction were sufficient, what would the heat produce? *Ans.*—Fire.

6. Mention some common occurrences which prove that friction will produce fire. *Ans.*—At night a spark of fire can be seen when the horse's shoe strikes a stone. Strike flint with a piece of steel, and a spark of fire is produced.

7. What causes the fire? *Ans.*—The substance is heated to the point where the oxygen of the atmosphere will unite with it.

8. What, then, is combustion? *Ans.*—It is the uniting of oxygen with certain other substances.

9. What is the point of temperature called at which the oxygen unites with a given substance? *Ans.*—The kindling point.

10. Have different substances different kindling points? *Ans.*—Yes.

11. How can you prove it? *Ans.*—By seeing which will burn the most readily.

12. What special wood is good for kindling? *Ans.*—Pine. Why? *Ans.*—Because it has a low kindling point.

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13. Has God anything to do with fire? Heb. 12:29.

14. Did God ever destroy anything by fire? *Ans.*—He destroyed Sodom and Gomorrah. Jude 7.

15. How will God destroy this earth? 2 Peter 3:10-12.

16. What will destroy the wicked? 2 Thess. 1:8; Rev. 20:15.

17. What preserves the righteous from being destroyed by fire? *Ans.*—Their righteous characters. Isa. 33:14, 15.

References.—"Parts of His Ways," section 2, chapter 11. Physics and Chemistry, see Combustion.

Suggestions to Teachers.—So common a phenomenon as fire ought to be understood by every one. Yet very few adults, even, can define the fire which they build daily in the stove. Fire is caused by the uniting of oxygen with some other substance. The oxygen of the air unites with the wood and coal. If the stove draft and damper be closed, the fire does not burn briskly. If all the air were shut from the stove, the fire would cease to burn. Open the draft, and see how quickly the fire increases. How do we know that oxygen will burn? Get a little oxide of mercury, and heat it in a glass tube. These can be secured for five or ten cents at a drug store. While heating the oxide of mercury, light a splinter, blow it out, and before the fire is completely extinguished, thrust it into the glass tube, and immediately it will burst into a flame. Oxygen uniting with coal or wood forms carbon dioxide. The friction produced by these two elements, carbon and oxygen, produces heat. Oxygen enters the lungs, and unites with the carbon of the body. Make this lesson as plain as possible by simple experiments. Burn some paper in an inverted glass over a saucer of water. Why does the water ascend into the tumbler? The oxygen was burned out of the air, and the water took its place.

LESSON XII.

The Study of a Match.

1. By what means at the present day do we light a lamp or start a fire? *Ans.*—We use matches.

2. What did past generations use? *Ans.*—Flint and steel.

3. Out of what kind of wood are matches made?

4. Why not use oak or maple?

5. With what material is one end of the match covered? *Ans.*—Phosphorus and sulphur.

6. Study the manufacture of matches.

7. How is the match lighted? *Ans.*—By rubbing one end of it on a rough surface.

8. Which end? Why rub it on a rough surface?

9. Why not use sulphur alone on a match? *Ans.*—Because the kindling point of sulphur is too high.

10. Why not use phosphorus alone? *Ans.*—Because its kindling point is too low. It will ignite without any rubbing. It has to be kept under water to prevent its burning.

11. What is the result of combining sulphur and phosphorus? *Ans.*—A substance is made which has a low kindling point. It is low enough so that very little friction produces sufficient heat to cause combustion.

References.—"Parts of His Ways," section 2, chapter 12. Chemistry, see Phosphorus and Sulphur.

Suggestions to Teachers.—This lesson will be of interest to the child, and will be a further illustration of the previous lesson. Study the match from the time the wood is taken from the forest, the sulphur from the earth, and the phosphorus from the ground and the bones of animals, until it is ready for use. Show how much more convenient the match is than the flint and steel used by our forefathers. You can study the texts of Scripture in which the word "brimstone" occurs, and learn how God uses it as an agent of destruction. In this lesson you can refer to the thermometer, which is used in measuring heat. Show that the efficiency of the thermometer depends on the expansive property of the mercury. When the weather is warm, the mercury expands, and rises; when it is cold, the mercury contracts, and descends in the glass tube. The children will be delighted to learn how to read the thermometer, and you can have them keep a daily record of the temperature of the weather. Have them keep a record of sunshiny days also. Three lessons more and we leave the study of Light and Heat; but the pupils should have become so interested, and so observing, that they will constantly be learning new facts even after they take up some other topic.

LESSON XIII.

What We Owe to the Sun.

1. What is the source of light and heat, about which we have been studying? *Ans.*—The sun.

2. For what purpose did God make the sun? *Ans.*—To rule the day. Gen. 1:16.

3. Enumerate some of the blessings of sunlight. *Ans.*—

(1) It sustains plant life. Potatoes growing in the cellar look pale and sickly.

(2) It sustains animal life. The animals live on plants, which depend on sunlight.

(3) It furnishes us with coal. Coal is formed of vegetation that flourished before the flood.

(4) It provides us with clothing. It causes the cotton plant to grow, thus furnishing the material for cotton clothing. It supplies plant food for the sheep, the source of wool for woolen clothing.

(5) It gives the power of vision. Eccl. 11:7.

(6) It magnifies objects—the microscope and telescope.

(7) It gives the green color to the grass and all vegetation. Plants growing in the dark are not green, but pale and sickly in appearance.

(8) Without the sunlight there would be no color.

(9) The sunlight will destroy disease germs.

4. Mention some of the blessings of the sun's heat. *Ans.*—

(1) Heat sustains plant life.

(2) Heat supports animal life. Without the sun's heat all life would cease; the whole earth would be colder than in the frigid zone.

(3) Heat gives the earth rain. The sun's heat changes the water into vapor.

5. Can you think of other ways in which light and heat give us temporal blessings?

6. Who gives to us the blessings which we receive from the sun's light and heat? Matt. 5:45.

7. To whom should we express our thankfulness for these blessings,—to God or to the sun?

8. Have people ever worshiped the sun? Why? Zeph. 1:4, 5.

References.—"Parts of His Ways," section 2, chapter 13; Astronomy, see Sun. "Principles of True Science:" See Sun, Sunlight, and Sunshine.

Suggestions to Teachers.—This lesson is a summing up of the blessings which come to us from the sun in the manifestations of light and heat. It will be an interesting exercise for the pupils to trace back to the sun the great majority of the blessings of life. The food they eat, the clothing they wear, the shoes on their feet, the warm fire to heat the house and to cook the food, are daily blessings which they can trace to the sun. Have the student trace back to the sun such common things as the lead-pencil, paper, mittens, cap, wood, coal, etc. This exercise will enable them to appreciate better the lesson on "What We Owe to the Sun of Righteousness," which follows. Of course all the blessings mentioned in this lesson come from God, but He dispenses them to us through the sun, which He causes to rise and to set both upon the righteous and the wicked. While the sun is the direct agent through which these blessings come, still it is to God we should render our gratitude and worship. We should not be like the heathen of whom Paul speaks in Rom. 1:25, for they worshiped the creature more than the Creator.

LESSON XIV.

What We Owe to the Sun of Righteousness.

1. Does the Word of God speak of a sun beside the one which was made on the fourth day of the creation week?

2. What sun is referred to? *Ans.*—The Sun of Righteousness. Mal. 4:2.

3. Who is indicated by the Sun of Righteousness? *Ans.*—Christ.

4. Whom besides Christ does the Word of God call a sun? *Ans.*—God. Ps. 84:11.

5. Why are God and Christ spoken of as suns? *Ans.*—Because they are sources of light. 1 John 1:5; John 8:12.

6. When Christ was transfigured upon the mountains, how did His face appear? *Ans.*—It shone as the sun. Matt. 17:2; Rev. 1:16.

7. Recount the blessings which come to us from the sun.

8. Mention some of the blessings which come to us from Christ, the Sun of Righteousness. *Ans.*—

(1) He gives the light of life. John 1:4; 8:12.
(2) He gives spiritual sight. Rev. 3:18; Eph. 1:18.
(3) He magnifies the law of God. Isa. 42:21.
(4) He gives zeal, spiritual heat. 2 Cor. 5:13, 14; Rev. 3:15, 16, 19.
(5) He gives all spiritual blessings. Eph. 1:3; Gal. 5:22, 23; 2 Peter 1:5-7.
(6) He will destroy the germs of sin. Micah 7:19; Isa. 6:5-7.

9. What would be the result if the sun should withdraw its light and heat from the earth? *Ans.*—Darkness and death.

10. What would be the result if the Sun of Righteousness should cease to shine into the hearts of men? *Ans.*—Spiritual darkness and death. 2 Peter 1:9; John 12:35; Matt. 25:30.

11. As we see the sun from day to day and enjoy its blessings, of what should it be a constant reminder? *Ans.*—Of the Sun of Righteousness, and of the spiritual blessings He so freely bestows.

12. Which should we seek first, the spiritual or the temporal blessings? Matt. 6:33. Why? 2 Cor. 4:18.

13. Are we not really dependent upon Christ for both spiritual and temporal blessings? Acts 14:17; 17:24, 25.

References.—"Parts of His Ways," section 2, chapter 14. "Principles of True Science:" Sun and Sun of Righteousness Compared, "Special Testimonies on Education," p. 52; "Testimonies for the Church," vol. 4, p. 342; Sun Represents the Creator.

Suggestions to Teachers.—Just as the sun is the means through which God bestows upon us the daily temporal blessings, so the Sun of Righteousness is the agent through whom God bestows upon us all spiritual blessings. As without the sun there would be physical death, so without the Sun of Righteousness there would be spiritual death. The sun, with all its power to clothe the earth with life and beauty, is a wonderful object lesson to us of how the Sun of Righteousness will clothe His followers with the robe of righteousness, and give to them the adornment of a meek and quiet spirit. This lesson will prepare the student to take up the study of "Light and Heat as Symbols in the Scriptures."

LESSON XV.

Light and Heat as Symbols.

1. What is the Bible definition of light?

2. What do scientists give as a definition of light? *Ans.*—It is that mode of motion which is capable of affecting the optic nerve.

3. What is the definite office of light? *Ans.*—To make manifest.

4. What is God? *Ans.*—Light.

5. What is His one purpose? *Ans.*—To make manifest, to reveal.

6. What does God reveal? *Ans.*—His character. Ex. 34: 5-7.

7. Through whom does He manifest Himself? *Ans.*—Through Christ. 1 Tim. 3: 16.

8. What are the different means by which God manifests Himself to the world called? *Ans.*—Lights.

9. Name some of these lights. *Ans.*—The Word, Ps. 119: 105; Christians, Matt. 5: 14.

10. How is the word "light" used in the above-mentioned texts? *Ans.*—As a symbol.

11. What is a symbol? *Ans.*—It is something with which we are familiar used to illustrate that with which we are not acquainted, as the sun, for the Sun of Righteousness; the water, for the Water of Life; our daily bread, for the Living Bread, etc.

12. Why are the common earthly things used symbolically in the Scriptures? *Ans.*—In order that as we see them from day to day, they may be constant reminders of heavenly truth.

13. Which is of the most importance, a knowledge of the symbol, or a knowledge of the truth symbolized?

14. What important truths are symbolized by light and heat? *Ans.*—

(1) Light is a symbol of righteousness and life. John 1:4-9; 8:12; 10:10.

(2) Heat is a symbol of zeal and earnestness. Rev. 3:15, 16.

15. Are the opposites of light and heat used symbolically in the Bible? *Ans.*—

(1) Darkness is a symbol of evil and unrighteousness. John 3:19; 12:35.

(2) Coldness is a symbol of indifference and a lack of zeal. Rev. 3:15, 16; Matt. 24:12.

References.—"Principles of True Science:" See Light; Darkness Represents Moral Corruption, "Testimonies for the Church," vol. 3, pp. 405, 427. "Parts of His Ways," section 2, chapter 15.

Suggestions to Teachers.—The pupils began the study of Light and Heat with the Word of God, and now they close that study with the Word of God. These great principles of truth have their foundation in the Bible, hence students should use it constantly as their guide. To those who have not been accustomed to study the Bible and science together, this method will seem a little strange, but children who are just beginning to study God's handiwork will take hold of this plan with great interest. This lesson completes the work of the first day of the creation week. Review the first five verses of Genesis, and have the pupils commit the verses of this chapter as fast as you traverse it in the lessons. Have the pupils imagine, as far back as possible, the condition of the earth as the light, accompanied by heat, shone upon the waters, for this will prepare them better to take up the study of the next chapter, on Air and Sound.

Chapter III.

AIR AND SOUND.

(Scripture Basis, Gen. 1:6-8.)

LESSON I.

Creation of the Firmament.

1. What did the Lord create on the first day?

2. What did He create on the second day? *Ans.*—The firmament.

3. What is the meaning of the word "firmament"? *Ans.*—An expansion. Gen. 1:6, margin.

4. Where was the expansion produced? *Ans.*—In the midst of the waters. Gen. 1:6.

5. What did the expansion cause? *Ans.*—A division of the waters. *Id.*

6. Was the division caused by making an expansion beneath the surface of the waters?

7. Are there seas of water above the earth, like the seas upon its surface?

8. What effect does the heat, which comes to the earth with the light, have upon the water? *Ans.*—It changes the water to vapor.

9. Did the light and heat have a similar effect upon the water the first day?

10. If so, what was the result? *Ans.*—The earth was enveloped in vapor.

11. In what two conditions did the water exist? *Ans.*—As a liquid, and as a vapor.

12. Where, then, was the firmament, or expansion, made? *Ans.*—Between the liquid and vaporized water.

13. What caused the expansion? *Ans.*—The creation of air by the Word of God.

14. How do you know that air was created? Gen. 1:20, 26. *Ans.*—Because it is said, "the fowl of the air."

15. What relation does the air have to the firmament? *Ans.*—The firmament is the space which the air occupies.

16. How does the air affect vapors? *Ans.*—It causes them to rise. Why? *Ans.*—Because they are lighter than the air.

17. Does the Bible indicate that the clouds once rested upon the earth's surface, but were lifted above it when God prepared the heavens? Prov. 8:27, 28.

Reference.—"Parts of His Ways," section 3, chapter 1.

Suggestions to Teachers.—On the second day God created the firmament. The same Word which spoke light into existence, caused an expansion in the midst of the waters. The work of the first day caused clouds and vapors to cover the face of the waters, and the work of the second day was to "establish the clouds above." Accordingly God made a firmament, or expansion, in the midst of the waters to divide the waters from the waters,—the liquid waters from the vaporized waters. The clouds are still separated from the earth. The atmosphere occupies the space between. The air was created, and the clouds, being lighter than the air, were lifted above the earth. That the air filled the firmament is shown by reading Gen. 1:20, where the Creator speaks of the fowls flying "in the open firmament of heaven." In verse 26 He calls the birds "the fowl of the *air*." The pupils will now begin to see that the work of the first two days of creation is connected. The light and heat formed the cloudy vapor; the air being created lifted it above the earth, thus forming an expansion, or firmament. Have the pupils study to discern the plan God was working out in creating the light, heat, and air.

LESSON II.

An Invisible Substance.

1. When did God create the air?

2. For what purpose did He make it? *Ans.*—To lift the clouds above the earth.

3. Is air a substance, or a form of energy like light and heat? *Ans.*—It is a substance.

4. What is substance, or matter? *Ans.*—It is anything that occupies space or has weight.

5. How do we usually detect matter? *Ans.*—By the use of one or more of the five senses.

6. How does air differ from ordinary matter? *Ans.*—

(1) It is invisible.
(2) It is odorless.
(3) It is tasteless.

7. How, then, do we know that air is material? *Ans.*—Because it occupies space.

8. Invert a tumbler and place it in a pan of water. Does the water rise in the tumbler? Why? Tip the tumbler to one side and note the result. *Ans.*—As the air bubbles up through the water, the water rises in the tumbler.

9. Blow into a paper bag. What is the result? Blow into a rubber bag or rubber ball and note the results.

10. What is pumped into the bicycle tires that makes it run so lightly?

11. Where is the atmosphere located? *Ans.*—It surrounds the entire earth, being about fifty miles deep.

12. According to our definition given above, matter must have weight. Has the invisible air weight? Prove your answer.

13. After all the air passes out of the inverted tumbler, lift it almost out of the water. What makes the water stay in the

tumbler? *Ans.*—The weight of the air pressing on the water outside the tumbler, forces it up.

14. Take a glass tube open at both ends; immerse it in water, and, placing the finger or hand over one end, raise it, keeping the other end in the water. Does the water act the same with the tumbler? Open the upper end, and notice what occurs.

References.—"Parts of His Ways," section 3, chapter 2. Chemistry, see Air or Atmosphere; Physics, see Air, Atmosphere, or Pneumatics; "Principles of True Science:" Air, Pure in the Beginning, "Spiritual Gifts," vol. 3, p. 33; "Patriarchs and Prophets," p. 44; Air Filled with Fragrance, "Spiritual Gifts," vol. 3, pp. 34, 35, 62.

Suggestions to Teachers.—That air is a substance may be doubted by some of the pupils, but the experiments mentioned above will make it plain that it occupies space, as does visible matter. It being a gas, which has no color, taste, or odor, its presence is not easily detected. You can mention other gases, such as ammonia, carbon dioxid, etc., which are invisible and yet readily recognized by their strong odor. The air can not be seen, but it may be felt when it is in motion. Air in motion is called wind. The air is a very thin substance, so that we can move about in it very easily. It is so easily pushed aside that we do not notice it unless the wind is blowing or we are running. God made a substance in which we might move and yet be scarcely aware of its presence. It is this substance which keeps us alive and operates the human mechanism.

LESSON III.

The Composition of Air.

1. In our last lesson what did we learn that air is? *Ans.*—A substance,—matter.

2. In what condition is air? *Ans.*—In a gaseous state.

3. Since air is a gaseous substance, of what is it composed? *Ans.*—Oxygen and nitrogen.

4. Set a piece of paper on fire, place it in a tumbler, and invert the tumbler over a saucer full of water.

5. What happens to the water in the saucer? Why? *Ans.*—The oxygen in the air is consumed by the burning of

the paper, forming a vacuum; so the water is forced up into the tumbler, taking the place of the oxygen.

6. Have in readiness a pan of water, a two-quart fruit can, and a piece of phosphorus as big as a pea. Place the phosphorus on a small float in the pan of water, heat a wire in the lamp flame, and touch the phosphorus with it, then place over this the two-quart can.

7. What becomes of the fumes of phosphorus oxid? *Ans.*—They are absorbed by the water.

8. Why has the water risen higher in the can? *Ans.*—To take the place of the oxygen burned out of the air.

9. What is left in the can? *Ans.*—Nitrogen. How can you prove it?

10. What proportion of the original amount of air is subtracted by the burning of the oxygen. *Ans.*—About one-fifth.

11. Then how much of the air is nitrogen? *Ans.*—Four-fifths.

12. How can we distinguish between nitrogen and oxygen? *Ans.*—Oxygen will support combustion, while nitrogen will not.

13. Place a glass or rubber tube in the inverted can, so that by pressing downward some of the gas will be forced through the tube. Place a lighted match in the stream of gas. If it burns more briskly, the gas is oxygen. If the flame is extinguished, it is nitrogen.

14. Who mixed the oxygen and nitrogen together to make the air? *Ans.*—The Creator.

15. Why did He cause one-fifth of the air to be oxygen and four-fifths nitrogen? *Ans.*—If the atmosphere consisted of oxygen alone, everything would burn up. Nitrogen is mixed with it, and acts as a damper.

References.—"Parts of His Ways," section 3, chapter 3. Chemistry, see Composition of Air.

Suggestions to Teachers.—The previous lesson has demonstrated that air is a substance; now the pupils will be interested to learn

of what elements the air is composed. The experiments in this lesson show that something was taken out of the air by the burning of the paper and phosphorus. In a previous lesson it was found that the oxygen of the air united with another substance in the process of burning, or combustion. The oxygen united with the paper and the phosphorus, forming carbon dioxid and an oxid of phosphorus. The latter was absorbed by the water so that the water rose in the jar, taking the place vacated by the oxygen. The remaining gas left in the jar is nitrogen. Some of this may be taken out by placing one end of a rubber tube under the water, extending it up into the nitrogen. Press down on the jar, and some of the nitrogen will be forced out. If the jar now rests on the bottom of the pan, pour in more water and press down again. In performing this experiment, use a deep dish; a dish-pan will do very well. This is an interesting experiment, and should not be omitted when it is possible to get the materials. The phosphorus may be obtained of a druggist. Be careful to handle the phosphorus with wet fingers. The phosphorus must be cut under water, and kept in water when not in use. Why?

LESSON IV.

Weight of the Air.

1. Why did the water in the inverted tumbler not run out when it was lifted nearly out of the water? *Ans.*—Because of the downward pressure of the air upon the water in the pan.

2. Fill a tumbler brimful of water, and place over it a sheet of paper. Place the palm of your hand over the paper and then invert the tumbler quickly. Remove the hand. Why does the water not run out of the tumbler? *Ans.*—Because of the upward pressure of the air.

3. To what is the pressure of the air due? *Ans.*—To the weight of the air.

4. Since the air extends upward fifty miles or more, does it not have great weight? *Ans.*—Being a gas, it is very light.

5. Can the weight of the air be determined? How?

6. Take a long glass tube, closed at one end. Fill with water and close the open end with the finger or hand. Then invert the tube, placing the end closed by the hand in a dish

of water. Remove the hand and note the results. *Ans.*—The water remains in the tube.

7. Would all the water remain in the tube, whatever its length might be? *Ans.*—If the tube is over thirty-four feet in length, the water will fall until it reaches that point.

8. Try the experiment given under No. 6, using mercury instead of water.

9. How high a column of mercury will the air sustain? *Ans.*—One of thirty inches.

10. Why does the air sustain a higher column of water than of mercury?

11. How can we compute the pressure or weight of the air which supports the water or mercury? *Ans.*—By pouring the water or mercury into vessels and weighing them.

12. How will this give the weight of the air? *Ans.*—The column of air and the columns of water and of mercury just balance each other; therefore their weights are equal.

13. What is the name of the instrument by which the weight of the air is measured? *Ans.*—A barometer. Describe it.

14. What is found to be the weight of a column of air at sea level, having an area of one square inch? *Ans.*—Fifteen pounds.

15. Can you think of any ways in which the weight of the air is a blessing?

References.—"Parts of His Ways," section 3, chapter 4. Physics, see Barometer.

Suggestions to Teachers.—How it is possible to weigh the air will be a puzzle to the students, but the above experiments will make it clear. When the scales balance an object, then the weight of the object is known; for it weighs exactly the same as the scale weights with which the weighing is done. The air and the water or mercury exactly balance each other, hence, by weighing the water or the mercury we obtain the weight of the air. Air presses in every direction, just as does water. With solids this is not the case, for the little molecules are so strongly attracted to each other that they have no pressure at the sides. The pressure of the air is very useful to us in raising water out of a deep well. This will be brought out in our next lesson, on "The Pump."

LESSON V.

The Pump.

1. Did you ever suck water through a straw, or glass tube?

2. What substance is in the tube before it is filled with water? *Ans.*—Air.

3. When you begin to suck through the tube, what goes into the mouth first? *Ans.*—The air.

4. As soon as you begin to draw out the air, what do you observe taking place at the lower end of the tube? *Ans.*—The water is rising in it.

5. When all the air is removed, what is the result? *Ans.*—The tube is completely filled with water, and the water enters into the mouth.

6. Is the water sucked up through the tube into the mouth, or is it pushed up? *Ans.*—It is pushed up by weight of the air on the water. Compare this experiment with those you had in your last lesson.

7. What common machine have you at your home which is operated by the same principle as was the tube, except that instead of the water being emptied into the mouth, it is poured into a pail?

8. What comes out of the pump during the first few strokes of the handle? *Ans.*—Air.

9. What follows the air? *Ans.*—Water.

10. What causes the water to rise in the pump? *Ans.*—The pressure of the air on the water in the well.

11. How high will the weight of the air lift water? Lift mercury?

12. When the pump handle is lifted, what is the result? *Ans.*—The piston or water-box is let down into the water, and the water runs into it through a valve which opens upward.

13. When the handle is pushed downward, what takes place? *Ans.*—The water is brought up in the piston, and a valve at the top of the piston, opening upward, lets the water out, and then the next downward stroke is made.

14. How many valves, then, are there in a pump, and which way do they open?

15. Draw a pump, with its pipe and piston, showing the two valves, and the way they open.

References.—"Parts of His Ways," section 3, chapter 5. Physics, see Pump.

Suggestions to Teachers.—In this lesson the student will make practical application of the truths he has learned with reference to the air. The air is a substance, and has weight, therefore it must be removed before the water can rise in a pipe or tube. The pressure upon the surface of the water outside the tube forces the water upward, where there is no resistance. If you have a long, straight lamp chimney, you can make a pump which will work nicely. Place a piece of cork in the lower end and make a valve in it which opens upward. Fasten to the lower end of a rod a piece of cork, which also has a valve opening upward. This piece of cork must fit the chimney perfectly, and yet so that you can work it up and down with the rod.

LESSON VI.

How the Birds Fly.

1. Where were the fowls which God created on the fourth day to fly? *Ans.*—In the open firmament of heaven. Gen. 1:20.

2. How are the birds spoken of in Gen. 1:26? *Ans.*—As the fowl of the air.

3. What do these texts of Scripture show? *Ans.*—That the birds were made to move about in the air.

4. Whose wisdom is manifested in the structure of the bird, so that it has the power of flight? Job 39:26, 27.

5. Did Solomon understand how a bird flies? Prov. 30:18, 19.

6. Has the Lord in these last days increased knowledge in science? *Ans.*—Dan. 12:4. "God has permitted a flood of light to be poured upon the world, in both science and art." C. E., p. 193; Sp. T. Ed., p. 8.

7. Can a bird fly without air?

8. What does the bird use in flying?

9. Examine a wing carefully, and notice its general shape when it is spread.

10. Does it resemble an open umbrella, in that it is hollow underneath and rounding on top?

11. Open an umbrella, lift it as high as you can reach, then pull down quickly on the handle. What is the effect? *Ans.*—It bounds back, tending to lift the person who holds it.

12. Place your finger over the open end of a bicycle pump after you have pulled out the handle. Now push the handle in quickly and let go. Why does the handle bound back quickly? *Ans.*—Because of the elasticity of the air.

13. Is rubber elastic? When air or rubber is crowded into a small space, what do we say of them? *Ans.*—They are compressed. When they are stretched out, what do we say? *Ans.*—They are expanded.

14. What do the wings of a bird do when they are moved rapidly in the air? *Ans.*—They compress the air, then the air expands and lifts the bird.

15. What causes the bird to go forward?

16. Take an umbrella with two or three of the ribs broken on one side, and pull it down suddenly as in No. 11. Why does the umbrella move forward? *Ans.*—Because the compressed air passes out on the weak side, and as it goes out it expands, and pushes the umbrella forward.

17. How does this principle apply to the bird's wings? *Ans.*—The front part of the wings is the strongest, while the back part, which consists of slender feathers, readily gives way and lets the compressed air escape. This expands and turns up the ends of the feathers, which act as sails.

18. Does not this study reveal the wisdom of God? Has man been able to make a flying machine that would equal the flying bird?

References.—"Parts of His Ways," section 3, chapter 6. Physics, see Expansion and Compressibility of Air.

Suggestions to Teachers.—Ask the pupils to watch the birds, and notice the different modes of flight. Compare the sparrow, dove, crow, hawk, and quail as to their mode of flight.

LESSON VII.

Wind.

1. What is wind? *Ans.*—Air in motion.

2. What causes air to move?

3. Place a light feather over a heated stove, and notice what happens to the feather.

4. Make a paper wheel, and mount it on the elbow of the stovepipe. If the stove contains fire, is the wheel affected differently than it would be if the stove were cold?

5. What causes the feather to rise, and the wheel to rotate, in the above experiments? *Ans.*—The currents of air caused by the heat of the stove.

6. What causes the draft in the chimney?

7. What causes the winds to blow over the surface of the earth? *Ans.*—The heat of the sun.

8. In what way does the heat of the sun's rays affect the air? *Ans.*—The rays of heat warm the air, and this causes it to expand. The expanded air is lighter, thus causing it to rise. As the warm air rises, the cold air rushes in to take its place.

9. Where on the earth does the air become heated the most? *Ans.*—In the equatorial region, embracing the torrid zone. Why? *Ans.*—Because the rays of the sun strike the earth more directly in that region.

10. What becomes of the heated air? *Ans.*—Part of it goes toward the north, and part toward the south.

11. Does it ever return to the equatorial region? *Ans.*—As it goes northward and southward it cools gradually, and as it cools it settles, and joins the currents going toward the equator.

12. Did Solomon understand anything about the wind currents? Eccl. 1:6.

13. To what does Christ compare the Spirit and its operations? *Ans.*—To the wind. John 3:8.

14. How did the Spirit of God descend on the day of Pentecost? Acts 2:1, 2.

15. What is the purpose of wind? *Ans.*—To carry about the moisture, in the form of clouds and vapors.

16. Make a drawing showing the wind circuits, one on each side of the equator, and indicate with arrows the directions in which the wind blows.

17. Who is the Author of the wind? Ps. 135:7; 147:18; Gen. 8:1.

References.—"Parts of His Ways," section 3, chapter 7. Physical Geography, see Wind.

Suggestions to Teachers.—By taking a light feather, or anything that will float in the air, you can show how the wind travels in circuits. Place the feather in the air current that is going toward the stove, and notice that as it approaches the stove it will ascend toward the ceiling; but gradually it will settle, and be drawn again toward the stove by the air currents. The wheel can easily be made by folding a piece of paper, and the reason of its rotation is explained by the windmill, moved by the wind outdoors. The operations of the Spirit of God are similar to those of the wind, in that the wind is invisible and yet powerful in its workings.

LESSON VIII.

The Breath of Life.

1. Of what material did the Lord form man? Gen. 2:7.

2. Had man life as soon as he was formed?

3. What did God do in order that man might become a living soul?

4. Into what did God breathe? *Ans.*—Man's nostrils.

5. Should the air enter the body through the nostrils, or the mouth?

6. Is God still breathing into man's nostrils? Job 27:3, margin; 33:4; Acts 17:25.

7. Are the lower animals, as well as man, dependent upon the air for life? Eccl. 3:19.

8. When God takes away the breath of life, what is the result. *Ans.*—Death. Eccl. 3:20; Ps. 104:27-29.

9. What element in the air sustains life? *Ans.*—Oxygen. How is the oxygen taken into the blood? *Ans.*—Through the lungs.

10. What do we throw off from the lungs? *Ans.*—Carbon dioxid.

11. What becomes of the carbon dioxid? *Ans.*—It is breathed in by the plants through the leaves.

12. What do the plants exhale? *Ans.*—Pure oxygen, ready for man to breathe again.

13. How can you prove this? *Ans.*—Collect some pond scum, put this in a dish of water, and place over it an inverted funnel. Fill the dish until the funnel is completely covered with water, and over the tube of the funnel place a filled inverted bottle of water. Little bubbles of oxygen will rise, displacing the water in the bottle. When the bottle is full, remove, and test for oxygen by using a lighted splinter.

14. What becomes of the carbon? *Ans.*—This is used to build up the plants.

15. Is carbon dioxid poisonous? *Ans.*—Many persons have lost their lives by going into wells and cisterns where this gas is present.

16. What lesson can we learn from this in regard to good ventilation?

17. What lesson can we learn from Christ breathing on His disciples? *Ans.*—John 20:22. That we need the Spirit of God to give us spiritual life, just as truly as we need the breath of life to give us physical life and energy.

References.—"Principles of True Science:" Breathing by God's Power, "Patriarchs and Prophets," p. 115; "Christian Education," p. 195; Air and Water Health Agents, "Testimonies for the Church," No. 32, p. 199; Air, the Necessity of Pure, "Testimonies for the Church," vol. 1, pp. 590, 701, 702. "Parts of His Ways," section 3, chapter 8. Physiology, see Respiration and Breathing.

Suggestions to Teachers.—The air is useful in many ways, and all of these ways show, not only the wisdom, but also the love of God. The air is a vital agent of life in plants, in animals, and in man. The Creator has so arranged that there should be no waste; for that which is rejected by the animals, is received by the plants; and that which is rejected by the plants, is received by the lower animals and man. It was the same Lord who created the air, plants, animals, and man, and adjusted their relations so that there should be no loss, and who said, when on earth as the Son of man, "Gather up the fragments that remain, that nothing be lost." Teach the lesson of carefulness and economy, and any other lesson which may have a practical bearing on the child's life. These practical lessons, which are valuable in character-building, should be given at every favorable opportunity. The next lesson will be on Ventilation, and should be made very practical.

LESSON IX.

Ventilation.

1. What did God breathe into man that made him a living being?

2. What part of the air sustains life?

3. What do we exhale from the lungs?

4. How does this affect the air about us? *Ans.*—It makes it unfit to breathe.

5. How much pure air is spoiled at each breath? *Ans.*—About three cubic feet.

6. If a person breathe fifteen times per minute, how long would it take to spoil the air in a room ten feet wide, twelve feet long, and eight feet high?

7. What is necessary in order to make such a room fit for one to live or sleep in? *Ans.*—Proper ventilation.

8. What is meant by ventilation? *Ans.*—It is the process by which pure fresh air is constantly provided.

9. How can we detect the presence of carbon dioxide? *Ans.*—

(1) By its odor, which is quickly recognized on coming in from the fresh air.

(2) By breathing into lime water it assumes a milky appearance.

(3) It will extinguish a flame.

10. How does the weight of carbon dioxide gas compare with air? *Ans.*—It is heavier than air.

11. Provide two two-quart cans. In one of these place a tablespoonful of soda. Pour on the soda a tablespoonful of vinegar. Carbon dioxid will be produced. Test the gas by lowering a lighted candle into the jar.

12. Slowly pour the gas (not the soda and vinegar) into the other jar. Test the gas in the second jar with the lighted candle.

13. What is indicated by the pouring of the carbon dioxid from one jar into another? *Ans.*—That it is heavier than the air.

14. Where in the room will the impure air be found? *Ans.*—Near the floor. Why?

15. Where should the opening for the escape of the impure air be located? Why?

16. Should the sick-room be ventilated? What influence does fresh air have on the body? What diseases are caused by poor ventilation? "Healthful Living," pp. 71-73; T., vol. 1, p. 702; vol. 3, p. 135.

References.—"Principles of True Science:" Air and Light Health Agents, "Spiritual Gifts," vol. 4, pp. 142, 144. "Parts of His Ways," section 3, chapter 9. Physiology, see Ventilation.

Suggestions to Teachers.—The question of health of the body should be emphasized constantly, for to develop the mind without developing the body is to give an unbalanced education. In the study of light, the necessity of raising all the window shades, and letting the sunlight into the rooms, should be urged upon the pupils. In the study of air, they should see the necessity of ventilating properly with fresh air. If these thoughts are introduced from time to time, students will note that physiology is the study of the proper relation of the body to what God has made about them. In studying ventilation, have the pupils work the simple problem of ventilating the school-room, and then you can study the ventilation of dwelling-houses and sleeping-rooms. Teach the children that it is a part of good religion to know how to use properly and enjoy the sunlight, air, water, food, etc., which God has so freely given to us.

LESSON X.

The Balancings of the Clouds.

1. What question did Elihu ask Job with reference to the clouds? Job 37:16.

2. What is meant by the balancing of the clouds? *Ans.*—The upholding of them in the firmament.

3. Does the same God who balances the clouds enable the birds to fly?

4. What does Elihu say of God's works and knowledge? *Ans.*—His works are wonderful and His knowledge is perfect. *Id.*

5. What does the prophet Isaiah say of God? *Ans.*—He is wonderful in counsel and excellent in working. Isa. 28:29.

6. What are clouds? *Ans.*—Water in a vaporized condition.

7. What means does God employ for making the water float, or balance, in the air? *Ans.*—He uses heat to change the water into vapor, then He uses air to lift it up into the firmament.

8. In what way does the air lift the vapor? *Ans.*—The air being heavier than the vapor, it remains below and pushes the vapor upward, just as an air bubble or piece of wood rises in the water.

9. Are all the clouds of the same height above the earth? Why not? *Ans.*—Some clouds are heavier than others, and each ascends to that place where the weight of the cloud and the weight of the air are equal, and there they are balanced.

10. Why did the feather, spoken of in a previous lesson, float in the air?

11. Why does the balloon go up into the air? *Ans.*—Because the top portion is filled with a gas called hydrogen, which is sixteen times lighter than the air.

12. Would the balloon ascend if it were filled with carbon dioxid? Why?

13. What was God's purpose in balancing the clouds in the air? *Ans.*—In order that He might carry moisture from the seas, lakes, and oceans, over the dry land, so that the plants created on the third day might grow and flourish.

14. What causes the clouds to move onward over the earth's surface? *Ans.*—Wind.

15. What was God working to bring about during the first two days of creation? *Ans.*—He was devising the water system which would provide the dry land with moisture, and this would cause the plants to grow for the service of man and the lower animals.

16. Describe the different kinds of clouds.

References.—"Principles of True Science:" Clouds are Controlled by God, "Patriarchs and Prophets," p. 115; "Christian Education," p. 196; Cloud Balancing, Studied by Adam, "Patriarchs and Prophets," p. 51; "Christian Education," p. 207. Physical Geography, see Clouds.

Suggestions to Teachers.—Call the attention of the children to the vapors they have seen rising from low, damp places in the early morning, the steam rising from the teakettle, and other examples which are familiar to them. This principle may be further illustrated by placing cork and light pieces of wood under water; also by breathing through a tube into the water. Fog may be illustrated by objects as heavy as water, which will neither sink nor rise. The pupils should see clearly that God was providing a way, during the first two days, to water the dry land. He had created the water before the light, and then the heat from the light formed vapors from the water; the creation of the air caused the vapors to ascend, and the wind caused by the heat carried the clouds hither and thither over the dry land, causing it to be watered. Have the pupils commit Eccl. 1:6, 7.

LESSON XI.

Air and Sound.

1. Would there be any sound were there no air?

2. Provide a large-mouthed flask bottle, or one-gallon tin kerosene oil can. Through the cork pass a rod, on the end of which fasten a small toy bell. Insert the cork with the bell, and shake the flask, noting the ring of the bell. Remove the cork and through it make an opening which may be filled with a tight-fitting plug. Fill the flask one-third full of water, and insert the cork, leaving the plug out. Heat the water over a lamp flame until it boils rapidly, then insert the plug, remove the flask from the flame, and let it cool for a few moments. Shake the flask again, and compare the sound of the bell with the previous one. If you have an oil can, you can use the spout for the opening in the cork.

3. You will hear the bell ring the second time you shake the flask, but it will be less distinct. Why?

4. Were all the air removed from the flask, what would be the result? *Ans.*—No sound would be heard.

5. What does this experiment show? *Ans.*—That air is the medium through which sound travels.

6. What organ does man have for recognizing sound? *Ans.*—The ear.

7. What other media have we for conducting sound? *Ans.*—Liquids and solids.

8. When in bathing, if the head be placed under water, and the water be struck a blow with the hand, the sound will seem louder to one who is completely under the water, than to one who is not. Why?

9. What does this show with reference to air and water as sound conductors? *Ans.*—That water is a better sound conductor than air.

10. Let a person stand at each end of a long piece of timber. If one scratch the end of the timber with a pin, and the other place his ear close to the timber, he will hear the sound very distinctly. Step a few feet away and no sound will be heard.

11. What does this experiment prove? *Ans.*—That wood and all solids are good conductors of sound.

12. As sound conductors, how do gases, liquids, and solids compare? *Ans.*—Solids are four times better than liquids, and liquids four times better than gases, making solids sixteen times better than air, and water four times.

13. How fast does sound travel? *Ans.*—It travels 1,190 feet per second. Count the seconds between the lightning and the hearing the thunder, then compute the distance. Why do we not hear the whistle of the steam-engine as soon as we discover the steam, when we are some distance away?

14. Is sound reflected as well as light and heat? What is the reflection called? *Ans.*—Echo.

15. Why can we hear farther in the morning than in the middle of the day?

References.—"Parts of His Ways," section 3, chapter 11. Physics, see Sound or Acoustics.

Suggestions to Teachers.—Here is brought to view another wonderful blessing of the air. Without air there would be no sound. By sounds we can communicate with each other; otherwise we would have to talk by signs, as do deaf-and-dumb people. The air makes

it possible to hear the sweet music of the birds, and the rippling of the brooks, and the patter of the rain. This lesson naturally introduces the subject of sound in connection with the study of air. We shall have several lessons on sound, which will reveal still more clearly the love and wisdom of God in creating the air.

LESSON XII.

How Sound Is Produced.

1. What is the purpose of a tuning-fork? *Ans.*—Musicians use it to obtain the correct pitch.

2. How is the tone produced? *Ans.*—By striking the fork upon the table, or by using the teeth.

3. How does this affect the tuning-fork? *Ans.*—It causes it to vibrate.

4. Strike the fork upon the table, then bring it quickly in touch with the tongue or the ear.

5. What causes the tickling sensation? *Ans.*—The trembling, or the rapid vibrations, of the prongs of the fork.

6. Strike with a stick the tines of an ordinary pitchfork. Is sound produced, as in the case of the tuning-fork?

7. If the tuning-fork prongs are touched while vibrating, what is the result? *Ans.*—The sound ceases. Strike the edge of a tumbler or goblet with a stick. Describe the results.

8. How is it that the ear receives the sound? *Ans.*—The vibrations of the fork set the air between the fork and the ear in motion. The air strikes against the tympanum of the ear, and it vibrates like the membrane in a drum when struck with the drum-sticks. The sensation is carried from the ear to the brain by the auditory nerve.

9. Cause the tuning-fork to vibrate, then place the lower end on the table. How does this affect the sound? Why? *Ans.*—Because the table is set to vibrating, thus causing more air to vibrate between the fork and the ear.

10. When sounds are produced which give a pleasant sensation, what are they called? *Ans.*—Musical tones.

11. Into what two classes is music divided? *Ans.*—Vocal and instrumental.

12. Did the Lord instruct Solomon to provide both vocal and instrumental music for their seasons of worship? 1 Chron. 15:16; 16:42; 2 Chron. 5:12; 20:21.

13. What Bible characters were skilful in the use of the voice and musical instruments? *Ans.*—Miriam, David, etc.

References.—"Parts of His Ways," section 3, chapter 12. Physics, see Sound Vibrations.

Suggestions to Teachers.—Sound is another mode of motion, which is recognized by the auditory nerve of the ear. The vibrating body causes the air to be set in motion, and, if the ear it not too far away, the air moves against the tympanum, and the three bones of the middle ear convey the vibrations to the inner ear, which is filled with fluid. This fluid is set in motion, and moves small stone particles against the small hairs which line the cavity of the inner ear, and which also connect with the auditory nerve. The little particles of air jostle against each other, but the farther out the air is from the vibrating body, the less the movement; hence sound can be heard only at a certain distance, depending on the intensity of the vibrations. You can illustrate this by setting up a row of blocks. If the first block is moved with much force against the second, more of the blocks will fall than would be the case if the first fell with simply its own weight against the second. The blocks represent the particles of air, and the movement of the blocks the movement of the particles of air. Have the pupils make drawings of the tuning-fork in motion and at rest, also of the blocks.

LESSON XIII.

Wind Instruments.

1. What is a wind instrument? *Ans.*—One that is operated by wind or air.

2. Name some of the more common wind instruments. *Ans.*—Flute, fife, piccolo, and flageolet.

3. How are these instruments operated? *Ans.*—By blowing into the end, or across an opening on the side near the large end.

4. How does the flageolet differ from the flute, fife, and piccolo? *Ans.*—It has an opening on the side, near the end opening, resembling in this respect an ordinary wood whistle.

5. How many tones can be produced by the common wood or tin whistle? *Ans.*—One.

6. How is it possible to produce so many different tones from a flute, fife, piccolo, flageolet, etc.?

7. Procure eight or ten bottles of different lengths. Blow across the mouths of these bottles, and see if they all produce the same tones. If you can not find bottles differing in length, take one from six to ten inches high, and blow across its mouth, and notice carefully the pitch of the tone produced. Pour in a little water and blow again. Is the pitch of the second tone the same as that of the first? Repeat the process of adding a little water and blowing, until your bottle is nearly full.

8. How many different tones were you able to produce? Can you produce the eight tones of the scale with a single bottle by using water?

9. How does the length of the bottle or tube affect the pitch of the tone? *Ans.*—The longer the bottle, the lower the pitch; the shorter the bottle, the higher the pitch.

10. Does the diameter of the bottle affect the pitch?

11. How is this principle, illustrated by the use of bottles, applied to the flute, piccolo, fife, etc.? *Ans.*—By opening and closing the holes on the side with the fingers, the tube of the instrument is shortened and lengthened.

12. How would you produce the lowest tone on a flute? *Ans.*—By closing all the openings. Why? Draw a fife or flute.

13. How is the sound produced in the wind instrument? *Ans.*—By blowing across the large side opening, the air in the tube is caused to vibrate. This sets the whole instrument to vibrating, and this in turn sets the air in motion between the instrument and the ear.

14. Did Israel use wind instruments? If so, for what purpose? Name some of the instruments used.

References.—"Parts of His Ways," section 3, chapter 13. Physics, see Wind Instruments.

Suggestions to Teachers.—If possible, secure a fife, flute, or piccolo for this lesson, as it always adds to the interest, and makes the principle clearer to have something which appeals to the eye. Let the pupils have part in the experimental work just as far as possible. It will be interesting work for the pupils to ascertain how many wind instruments were in use in Bible times, and to learn the purpose for which they were used. The next lesson will be a study of "Reed Instruments," which are similar to the wind instruments.

LESSON XIV.

Reed Instruments.

1. Review briefly the lesson on wind instruments.

2. What instruments have we that are similar to the wind instruments? *Ans.*—The reed instruments.

3. Name some of the common reed instruments. *Ans.*—Organ, mouth-organ, clarionet, etc.

4. In what respect are these two classes of instruments similar? *Ans.*—Both are operated by wind.

5. In what respect do they differ? *Ans.*—The reed instruments have one or more thin wood or metallic plates, called reeds, which vibrate as the air is forced through the instrument.

6. Compare the clarionet with the flute. *Ans.*—The clarionet has the side openings, but a wooden reed is placed at one end, while the other end is trumpet-shaped.

7. How do the organ and mouth-organ differ from the clarionet? *Ans.*—These instruments have many reeds, which are made from metal instead of wood. The air is forced into the organ by the use of pedals, operated with the feet, while

the mouth-organ, as the name indicates, is operated by the mouth.

8. Remove one of the sides of the mouth-organ. What do you notice as to the length of the reeds, and how does their length affect the tones they produce? *Ans.*—The longer reeds produce lower tones, while the shorter ones produce higher tones.

9. Is this same principle carried out in the wind instruments?

10. Do the thickness and width of the reed modify the tone? Fasten in a vice strips of wood and metal, varying in length, breadth, and thickness, and note the tones produced by causing them to vibrate.

11. In instruments which have but one reed, how are the different tones produced? Draw the mouth-organ and clarionet.

12. Which produces the sweeter music, wind or reed instruments?

13. Were the reed instruments used in Bible times?

14. Who was the first maker of musical instruments? and what kinds did he make? Gen. 4:21.

References.—"Parts of His Ways," section 3, chapter 14. Physics, see Reed Instruments.

Suggestions to Teachers.—You can illustrate the vibratory action of the reed by the splinter on the side of the house, which produces a buzzing or rattling tone when the wind blows. Take three or four leaves of a book, and blow across their edges; this also will illustrate the vibration of the reed. You can certainly have a mouth-organ to examine, and perhaps an organ. Take the mouth-organ apart, so that the student may clearly see how it is constructed. Have them draw one side of the mouth-organ, showing the reeds of different lengths, and how they are fastened.

LESSON XV.

Stringed Instruments.

1. What is a stringed instrument? *Ans.*—An instrument which produces sound by the vibrations of strings or cords.

2. Name a few of the common stringed instruments. *Ans.*—Violin, guitar, piano, harp, mandolin, etc.

3. How are the tones produced on the stringed instruments? *Ans.*—By causing the strings to vibrate. This is done by picking the strings with the fingers, or using a bow.

4. Fasten a strong cord to the door-knob; pull the cord with one hand, and pick it with the other. What is the result? Take hold of the string one foot from the place where it is fastened; pick it with the other hand. Keep the tone in mind, and repeat the experiment with a two-foot, three-foot, and four-foot string, and compare the tones as to pitch.

5. Is the pitch the same whatever be the tension of the string? *Ans.*—The looser the string, the lower the pitch; the tighter the string, the higher the pitch.

6. Does the diameter of the string affect the tone?

7. Provide several strings and wires with different diameters. Fasten the strings and wires to an old table by means of nails driven about two inches apart into the ends of the table. Make five or six triangular bridges six inches in length. Place one of these at each end of the table, and use the rest as you need them for lengthening and shortening the strings. Produce as many tones as you can, and notice the conditions governing the pitch.

8. On what three things does the pitch depend? *Ans.*—

(1) Length of string.
(2) Tension (tightness) of string.
(3) Diameter of string.

9. How are the conditions regulating pitch applied to the violin, guitar, etc.? *Ans.*—Strings of the proper diameter

7

are secured; the tension is regulated by keys; the length of the strings, by the fingers of the left hand, and the picking of the strings, by the fingers of the right hand.

10. How are the tones produced on the piano? *Ans.*—Wires of the proper length and diameter are placed in the piano, and these, by pressing the keys down, are struck by hammers, which cause the wires to vibrate.

11. How does the music of the stringed instruments compare with that of the wind and reed instruments?

12. Did the children of Israel use stringed instruments? Name some of them.

13. What was David's favorite instrument?

References.—"Principles of True Science:" Instruments, Stringed, "Great Controversy," p. 646; Harps Hushed When Adam and Eve Sinned, "Spiritual Gifts," vol. 3, p. 44; Harps of Gold in Heaven, "Great Controversy," p. 678; Harps Used by Angels, "Spiritual Gifts," vol. 4, part 2, p. 31. Physics, see Stringed Instruments. "Parts of His Ways," section 3, chapter 15.

Suggestions to Teachers.—You can very easily make a sonometer on a table, as suggested in No. 7, which will illustrate the principles underlying all stringed instruments. After these principles are understood, you can apply them to the violin, guitar, or any stringed instrument that you may procure. This lesson completes the study of musical instruments, and will be followed by a lesson on the "Purpose of Sound," especially considering the human voice, its training and its possibilities.

LESSON XVI.

The Purpose of Sound.

1. Has man a musical instrument in his body?

2. Where is it located? *Ans.*—In the windpipe, at the point called "Adam's apple."

3. How is this instrument operated? *Ans.*—By the breath passing over the vocal cords, as it passes from the lungs.

4. What is the sound produced called? *Ans.*—The voice.

5. Are the vocal cords similar to those used in stringed instruments? *Ans.*—Instead of being slender strings, they

consist of extensions of thin membrane from the sides of the windpipe. This membrane may be loosened or tightened by muscles. The membrane vibrates like a reed as the air passes over it.

6. To what class of musical instruments does the human instrument belong? *Ans.*—Since it requires air to operate it, and since the membrane vibrates like a reed as the breath passes over it, the voice instrument would seem to belong to the reed instruments. But on account of the cords being loosened and tightened, as the pitch requires, it might be called a stringed instrument. The human musical instrument is, therefore, a combination of both the reed and stringed instruments.

7. Why did the Creator give to man the power to express himself by sounds? *Ans.*—That he might converse with his Creator and with his fellow-beings.

8. What should be the character of our expressions to God? *Ans.*—Prayer and praise.

9. Do the birds, insects, and all lower animals have the power of expression for the same reason?

10. Did the children of Israel use their voices in singing? Ex. 15; 1 Chron. 16; Ps. 47:1; 95:1-3; 2 Chron. 20:21, 22; Ezra 2:65.

11. What did David want everything that has breath to do? Ps. 150:6.

12. Is every living thing now praising the Creator? Why?

13. Will the time ever be when all God's creatures will praise their Creator? Rev. 5:13.

14. Will that song of praise ever cease? *Id.*

15. Are the heavenly beings continually praising God? Rev. 4:8; 5:11, 12.

16. Should we cultivate our voices, and learn to play on musical instruments? Ps. 149:3-6; 150:3-5.

17. What kind of music should we produce with the voice and musical instruments? *Ans.*—That which will glorify God. 1 Cor. 14:15; Eph. 5:19.

18. What would you say was the great purpose of God in providing sound?

References.—"Principles of True Science:" See Music. "Parts of His Ways," section 3, chapter 16. Physics, see Musical Sounds.

Suggestions to Teachers.—The thought to be impressed upon the mind in this lesson is that the power to talk and to sing should be so used that God will be glorified. If we learn to play musical instruments so that we can use them in praising God, then our souls will be elevated by their use. The voice should be trained to speak clearly and musically, so that others will be edified by what we say. We should be training our voices to sing and our hands to play in the heavenly choirs. Rev. 14:1-3; 15:2; 5:8.

LESSON XVII.

The Blessings of the Air and of Sound.

1. Mention some of the blessings that come as a result of God's creating the air. *Ans.*—

(1) It causes the vapors to ascend.
(2) As wind, it carries the clouds over the dry land.
(3) It causes plants to grow.
(4) It enables the birds to fly.
(5) Its weight is useful in lifting water.
(6) As wind, it is a propelling power; illustrated by the sailboat and windmill.
(7) It sustains plant and animal life.
(8) The oxygen of the air supports combustion.
(9) It is a sound conductor.
(10) It operates wind and reed instruments.
(11) It operates the instrument that produces voice.

2. Who controls the air? Matt. 7:24-26; Mark 4:37-39.

3. What does air symbolize in the Bible? *Ans.*—The Spirit of God. John 3:8; Acts 2:1, 2; John 20:22.

4. In what ways is sound a blessing? *Ans.*—

(1) It is used in calling. The dinner bell, the school and church bell are illustrations.

(2) It is used to give warning of danger, as are the rattles of the rattlesnake, as is the fog horn on the seacoast, and the fire bell in the engine-house.

(3) It is a means of communication.

(4) The sweet, melodious songs of man and the lower animals delight the ear.

(5) Music, both vocal and instrumental, is a means by which the feelings and the emotions of the soul are expressed.

5. Of what are musical sounds as expressed in song a symbol? *Ans.*—They are a symbol of a life that is sweet and beautiful, because it is actuated by the love of Christ; and it carries with it inspiration and joy, so that those who come in contact with such a life are blessed and cheered.

6. To what is a life that is destitute of love compared? *Ans.*—To sounding brass and tinkling cymbal. 1 Cor. 13:1.

Suggestions to Teachers.—This lesson is a review of the entire chapter, summing up the blessings which come to us through air and sound. The love of God is seen in adapting the things He has made to our needs. The wisdom of God is seen in making things in such a way that they minister to us in our daily living. To enable the students to see the great love of God should be the constant aim of the teacher; for, when that is seen, they will commit their souls unto God, to be saved by the same power which they see manifested in the works of God about them. The next chapter will take up the study of Water, which God designed to distribute over the dry land by the working together of light, heat, and air, which were created on the first two days of creation week.

Chapter IV.

WATER.

(Scripture Basis, Gen. 1:9, 10.)

LESSON I.

The Gathering of the Waters.

1. What covered the earth when it was first created? *Ans.*—Water. Gen. 1:1, 2.

2. What moved upon the face of the waters? *Id.*

3. In what forms did the water exist on the first day? *Ans.*—As a liquid and as vapor.

4. What caused the vapor? *Ans.*—Light and heat.

5. What did God do on the second day? *Ans.*—He created the air, which separated the liquid from the vaporized water.

6. What was the first thing that God did on the third day? *Ans.*—He gathered the waters together into one place. Gen. 1:9; Ps. 95:5; 136:6.

7. How was this accomplished? *Ans.*—By His word.

8. What did the gathering together of the waters cause to appear? *Ans.*—The dry land.

9. How much of the earth at the present time consists of water? *Ans.*—About three-fourths.

10. What decree did God make concerning the waters? Prov. 8:29, 30; Job 38:10, 11; Jer. 5:22.

11. What is the shape of water surface? *Ans.*—Circular. Prov. 8:27, margin.

12. What is the shape of the earth? *Ans.*—Round like a ball.

13. Out of what did God create the land and water? *Ans.*—Out of things which do not appear. Heb. 11:3.

14. What did He call the dry land? *Ans.*—Earth. The waters? *Ans.*—Seas. Gen. 1:10.

References.—"Parts of His Ways," section 4, chapter 1.

Suggestions to Teachers.—We now come to the water, one of the most wonderful and beneficial substances that God has made. The original substances composing the earth are land and water. The land was hidden by the water until the third day. On this day God spoke to the waters, and by the power of that word they were gathered together so that the dry land appeared. In this lesson you can use to advantage a globe to represent the shape of the earth. If you are not provided with this, use an apple or an orange. It will not be best in this chapter on water to go into the study of the geographical distribution of the water over the earth's surface, as that can be taken up to better advantage when you study the dry land. This chapter will deal mainly with the nature and utility of water, showing the wisdom and purpose of God in its creation. These two chapters on Land and Water will furnish a natural basis for the study of geography. With children I would have no separate class in geography, but a class in nature study, which would begin the subject matter usually treated in geography.

LESSON II.

The Distribution of Water.

1. What did God call the waters He had gathered together? *Ans.*—Seas. Gen. 1:10.

2. What are these great bodies of water now called? *Ans.*—Oceans.

3. How many oceans are there? *Ans.*—Five. Name them. *Ans.*—Atlantic, Pacific, Arctic, Antarctic, and Indian.

4. What separates the oceans? *Ans.*—The dry land.

5. What do we call the bodies of water next in size to the oceans? *Ans.*—Seas. Who made the seas? Ps. 95:5.

6. What is a lake? *Ans.*—A body of water entirely surrounded by land.

7. What is the difference between the water in the lakes

and that in the oceans and seas? *Ans.*—The water of the seas and oceans is salty, while the water of the lakes is not.

8. What other bodies of water have we in the dry land besides lakes? *Ans.*—Rivers, creeks, brooks, and springs.

9. What is a river? Brook? Spring?

10. Where does the water in the rivers, brooks, and springs come from? Where is it going? Eccl. 1:7.

11. Can you give a reason for inland water not being salty?

12. What is God's purpose in taking the water out of the ocean, and raining it upon the dry land? *Ans.*—To give drink to the animals, and to cause the plants to grow. Ps. 104:10-13.

13. What lesson does the Lord teach us by means of the river? *Ans.*—Lessons of peace. Isa. 48:18.

14. What lesson does He teach us by means of the spring of water? *Ans.*—That our lives may flow out constantly in blessings to others, just as the spring never ceases to bless those who come to partake of its ever-flowing water.

15. Which water is the purest, that which is found in the running brook and bubbling spring, or that which is found in the quiet pond? Why?

16. What lesson did Jesus teach the woman of Samaria at Jacob's well? John 4:5-15.

17. What is the opposite of a well? *Ans.*—A cistern.

18. Does the Lord compare the experience of Christian people to cisterns?

19. What is the difference between a Christian who is like a spring, or a well of water, and those who are like cisterns?

References.—"Principles of True Science:" See Rivers and Brooks. "Parts of His Ways," section 4, chapter 2. Geography, see Divisions of Water.

Suggestions to Teachers.—In this lesson the child will become acquainted with some of the natural divisions of water, and the purpose God had in view in making rivers, brooks, creeks, springs, etc. Not only the plants need the refreshing and reviving influence of water, but the birds and beasts also. The Lord employs the terms "spring," "river," "well," "cistern," etc., in His Word to teach lessons of deep spiritual truth, which should be treasured in the heart and lived in the life. The next lesson will treat of the composition of water.

LESSON III.

The Composition of Water.

1. Is water a substance? Prove your answer.

2. In what respect is water unlike air? *Ans.*—Water is a visible substance.

3. In what respects are water and air alike? *Ans.*—Pure water, like pure air, is odorless and tasteless; also, it is composed of two elementary substances.

4. Name the two elements which compose air.

5. Is water composed of the same elements? *Ans.*—It contains oxygen the same as the air; but the name of the other element is hydrogen.

6. How can we prove that air is composed of two gases,—oxygen and nitrogen?

7. Make two piles by using alternate pieces of copper and zinc. The pieces may be obtained from a hardware store, and should be about an inch and one-half square. Make the piles about four inches high. Cloth disks should be placed between the zinc and copper after they have been dipped in vinegar. If two piles are not strong enough, make another, attaching the third pile to the first two by wires. The wires from the first two piles should be three feet in length. The free ends of the wires should be placed in a dish of water. Bubbles of gas will come from the ends of the wires, and this may be collected by placing over the wires two inverted bottles filled with water.

8. Test the gas which comes from the wire fastened to the copper plate for oxygen.

9. Test the gas in the other bottle with a burning splinter, but do not turn the bottle right side up. Why? *Ans.*—For this gas is sixteen times lighter than oxygen, and would escape.

10. How does the hydrogen act on the flame? *Ans.*—It extinguishes it, but burns at the base of the bottle where the

air and the hydrogen are in contact. Test for hydrogen in a dark room.

11. Which bottle fills with gas first? *Ans.*—The one collecting the hydrogen.

12. If you notice carefully, you will see that the bottle containing hydrogen will fill by the time the bottle collecting oxygen is one-half full. What does this show? *Ans.*—That water contains twice as much hydrogen in volume as oxygen.

13. What is the nature of hydrogen? *Ans.*—It is a very light gas, having no color, taste, or odor.

14. What condition of matter is air?

15. What condition of matter is water? *Ans.*—A liquid.

References.—"Parts of His Ways," section 4, chapter 3. Chemistry, see Composition of Water.

Suggestions to Teachers.—Do not fail to perform this experiment of breaking up water into oxygen and hydrogen. You can have the pieces of copper and zinc cut at the hardware store into just the right size. Cut out little disks of cloth and place between the copper and zinc plates, as this will allow the vinegar to come in better contact with the zinc. Add a little sulphuric acid to the water which contains the two ends of the wires, as this will make the electricity flow more readily.

LESSON IV.

Water Level.

1. Should you make a hole in the bottom of a tank filled with water, what would happen? In the side? Remove one side, and what would be the result?

2. Should a mouse gnaw a hole through the bottom of a wheat-bin, what would be the result? Remove one side of the wheat-bin, and what would take place?

3. Try a similar experiment with a box filled with sand, and compare the results with those of the wheat-bin and water-tank.

4. What is the difference between the action of the water, and the wheat and sand? *Ans.*—The little particles (mol-

ecules) composing the water are so slippery that water keeps a level surface, and all of it passes out of the dish if there is a hole in the bottom, or if one of the sides is removed. The little sand grains have rough and irregular edges and faces, so that they cling together more or less. This is true of the wheat also, and of solids in general. On this account only a small part of the wheat and sand passes from the box and bin.

5. Place very carefully, with a medicine dropper, a drop of colored fluid in a dish of water; the drop should be placed at one side, near the bottom of the dish. Let the dish remain several days without being disturbed.

6. What takes place in the dish of water? *Ans.*—The colored fluid moves about in the dish.

7. What does this experiment prove. *Ans.*—That the little molecules of the fluid are not stationary, but move about in the fluid.

8. How can we best illustrate the slipperyness (mobility) of a fluid? *Ans.*—Try to make a pyramid out of small shot. Oil the shot, and try it again. You can not make the shot as slippery as are the molecules of water.

9. Why is the surface of a liquid always level? *Ans.*—Because of the great mobility of the water.

10. Would we have any running brooks and bubbling springs if the water were not mobile?

11. Look at a tumbler of water. What is its color? Taste of it. How does it taste? Smell of it. What kind of odor has it?

12. Since it has neither taste nor odor, why do we like it so well? How does it compare with other beverages?

References.—"Parts of His Ways," section 4, chapter 4. Physics, see Hydrostatics and Mobility of Water.

Suggestions to Teachers.—In this lesson the child is to become acquainted with water in just as many ways as possible. Impress upon the mind that it was the drink which the Creator made for man, and that man can make nothing that will compare with it. It is what God has provided for beasts and birds and all the creatures that live on the earth. It is better than tea, coffee, cider, or any of the drinks which man has made to satisfy a perverted appetite.

LESSON V.

The Conditions of Water.

1. Water is what condition of matter? *Ans.*—A liquid condition.

2. Can water be changed into other conditions?

3. Place a teakettle of water on the stove, and build a hot fire. What happens after a few minutes? *Ans.*—The water comes out of the teakettle spout as steam.

4. Can steam be seen? *Ans.*—Look close to the end of the spout. You will see nothing until about one inch away from the end, showing that steam, like air, is invisible.

5. What is that which we see a little distance from the spout of the teakettle? *Ans.*—Cooled steam, called vapor.

6. What changes water into steam? Why is it invisible? *Ans.*—In the previous lesson we learned that the little molecules of water are very smooth, and move about among each other; but heat causes the molecules to separate, and, being very light, they pass off into the air.

7. What is this process of changing the water into a gas called? *Ans.*—Evaporation.

8. Will the heat of the sun evaporate water? *Ans.*—Place a tumbler of water in the direct rays of the sun, and take note from day to day of the amount of water it contains.

9. If cold is applied to water, does any change take place? *Ans.*—Place a dish of water out-of-doors some cold day, and note the change which takes place.

10. What name do we give to frozen water?

11. What produces ice? *Ans.*—Cold.

12. Does steam occupy more space than water?

13. Does ice occupy more space than water? *Ans.*—Take an old dish and fill it with water. Let all the water turn to ice, and note the effect on the dish.

14. On a very cold night should we allow tubs or glass jars containing water to remain out-of-doors? Why?

15. What is the result of ice occupying more space than the water? *Ans.*—The ice floats on the water.

16. Does this reveal the wisdom and care of the Creator? *Ans.*—Should the ice sink as fast as it is formed, all the water would turn to ice, and all the animals living in the water would perish.

17. Are ice and steam water? Give proof. *Ans.*—Add heat to ice and it will melt. Place a cold plate over the steam coming from a teakettle, and drops of water will appear on the edge of the plate.

18. What are the three conditions of water?

References.—"Parts of His Ways," section 4, chapter 5. Physics and Chemistry, see Conditions of Water and Hydrostatics.

Suggestions to Teachers.—The facts in this lesson are more or less familiar to the minds of children, and because of this the teacher will be prone not to carry out the experimental work. This should be thoroughly done, as the future lessons on water will be based very largely upon this lesson. Teach the pupils to be careful at home about leaving jars, pails, and tubs filled with water, when there is danger of freezing.

LESSON VI.

Liquid Water.

1. Into how many conditions can water be changed? Name them, and explain by what means the change is wrought.

2. Does the weight of the air on water hinder it from boiling? *Ans.*—The greater the air pressure, the more heat required. Water boils quickest when the dish is covered. Why?

3. When the pressure of air is 15 lbs. per square inch, how much heat is required to cause water to boil? *Ans.*—It requires 212 degrees Fahrenheit, and 100 degrees Centigrade.

4. Why is it so difficult to cook beans and potatoes on a mountain?

5. What are some of the common forms of liquid water called? *Ans.*—Rain, dew, and mist.

6. Who makes the rain? Matt. 5:45; Ps. 147:7, 8; Jer. 10:13; Job 38:26-28.

7. Can He give or retain the rain just as He pleases? (Read the account of the famine in Egypt; the famine which came in answer to Elijah's prayer when Ahab was king of Israel; and of Gideon's fleece of wool.)

8. By what means does the Lord provide rain? *Ans.*—By means of light, heat, air, and water. Rain is distilled. Job 36:27, 28.

9. Did God water the earth with rain in the beginning? *Ans.*—Gen. 2:4-6. He watered it with dew or mist. P. P., pp. 96, 97.

10. When did the first rain fall upon the earth? *Ans.*—At the time of the flood.

11. How is dew formed? *Ans.*—The earth cools at night, and the moisture in the atmosphere condenses, forming little drops of water upon the grass and herbs. Dew is distilled. Deut. 32:2.

12. What common occurrence in the warm days of summer illustrates how dew is formed? *Ans.*—The sweating of the water pitcher.

13. What is God's purpose in forming rain or dew? *Ans.*—To give life to plants and animals.

14. What spiritual lessons does God teach us in His Word from the rain and dew? *Ans.*—

(1) He likens the work of the gospel to rain and dew. Deut. 32:2.

(2) He likens His word and the effect it produces to rain. Isa. 55:10, 11.

(3) He will refresh His people, and cause them to grow, even as the dew does the lily. Hosea 14:5.

(4) The rain of the Holy Spirit is called the early and the latter rain.

References.—"Principles of True Science:" Dew Watered the Earth before the Flood, "Patriarchs and Prophets," pp. 96, 97; "Spiritual Gifts," vol. 3, pp. 68, 69; Dew of Grace, "Testimonies for the Church," vol. 4, pp. 315, 466; Dew and Seed, "Testimonies for the Church," vol. 3, p. 248; Dew and Rain, "Testimonies for the Church," No. 32, p. 68; see Rain also. "Parts of His Ways," section 4, chapter 6. Physical Geography, see Dew and Rain.

Suggestions to Teachers.—This lesson connects God with His work, and yet shows that He uses means to accomplish that work. The carpenter's tools would be of no account were there no one to use them; so light, heat, and air can do nothing without a power behind to operate them. The Creator points us to the rain and dew to illustrate the working of the gospel in the heart. Read the first psalm and Jer. 17:5–9.

LESSON VII.

Solid Water.

1. What are the liquid forms of water, and how are they produced?

2. Name some of the frozen forms of water. *Ans.*—Ice, hail, snow, and frost.

3. Who causes these to appear on the earth? *Ans.*—

(1) He casteth forth His ice like morsels. Ps. 147:17.

(2) The treasures of the hail God has reserved against the time of trouble. Job 38:22, 23.

(3) He gives snow like wool. Ps. 147:16.

(4) He scattereth the hoarfrost like ashes. Ps. 147:16; Job 38:29.

4. How is ice formed?

5. How is hail produced? *Ans.*—By the rapid freezing of the rain-drops before they reach the earth. This freezing is caused by cold currents of air.

6. What produces snow? *Ans.*—Small particles of water in the atmosphere freeze gradually, forming the beautiful snowflake crystals.

7. What produces frost? *Ans.*—The dew which covers the ground is frozen, thus forming a white, hoary covering.

8. What wise purpose do ice and snow serve on the earth? *Ans.*—

(1) The ice covers the lakes and ponds, forming a protection to the creatures living in them.

(2) The snow forms a warm blanket for the earth, thus protecting the roots and seeds in the ground.

9. Do you know of any people who build their houses of snow and ice?

10. For what purpose is ice used in the home in summer?

11. Why do most people like to see the snow come in winter?

12. Why do snow sleighs have iron shoes on the runners?

13. Why do they draw hard on the bare ground?

14. What property of water have we studied which makes the snow sleigh draw easily? *Ans.*—Mobility.

15. What spiritual lessons does the Lord teach us by referring to ice, hail, snow, and frost?

16. For what purpose will the Lord use hail when the plagues are poured out? Job 38:22, 23; Rev. 16:21.

17. What will be the weight and size of each hailstone? *Id.*

References.—"Principles of True Science:" Icy Spirit, "Testimonies for the Church," vol. 3, p. 534; Iceberg Christians, "Gospel Workers," p. 382; Hail, Destructive Agent, "Great Controversy," p. 637; Snow Given by God, "Patriarchs and Prophets," p. 115; "Christian Education," p. 196. "Parts of His Ways," section 4, chapter 7. Physical Geography, see Ice, Snow, Hail, and Frost.

Suggestions to Teachers.—Show how God's power is back of all the things which we see, and yet He permits Satan to use these things in a wrong way, as in the case of Job, when storms and pestilence destroyed all he had. But God will permit nothing to come to us but that will be for our good. Extreme cold and heat have come upon the earth as a result of sin. Before the fall the temperature was even and the air was pure. Read chapter on Creation in "Patriarchs and Prophets."

LESSON VIII.

Vaporized Water.

1. Name over the different forms of liquid and solid water.

2. Give some of the spiritual lessons which they teach.

3. What other form of water have we? *Ans.*—Vaporized water.

4. How is it produced? *Ans.*—Heat causes the water to evaporate, thus changing it from a liquid to a gas.

5. Name some of the different forms of vaporized water. *Ans.*—Steam, vapor, clouds, and fog.

6. How does steam differ from vapor? *Ans.*—Steam is invisible, while vapor is not.

7. Is there any difference between clouds, fog, and vapor? *Ans.*—Clouds float high in the air, while fog and vapor are nearer the surface of the earth.

8. What becomes of vapor? *Ans.*—It ascends and forms into clouds.

9. What causes vapor to ascend? Ps. 135:7; Jer. 10:13; 51:16.

10. Why does the Creator cause it to ascend?

11. Where on the earth's surface is most of the vapor formed? *Ans.*—On the oceans.

12. Does the water carried into the sky in the form of vapor ever return to the ocean again? Eccl. 1:7.

13. Does the air contain moisture, even where there is no vapor to be seen?

14. What becomes of the moisture in clothes which are hung out to dry? *Ans.*—It passes off into the air.

15. Why do the clothes dry faster on some days than on others?

16. Why will persons sweat more freely at one time than at another, even if the temperature is the same? Is it a blessing to sweat? Gen. 3:19.

17. Study the different kinds of clouds, as to their shape, color, height, etc.

18. What spiritual lessons does God's Word teach us through clouds and vapors? Jude 12; Hosea 6:4; 13:3; 2 Peter 2:17; Isa. 44:22; James 4:14.

References.—"Principles of True Science:" Vapor Ascends by the Power of God, "Patriarchs and Prophets," p. 115; "Christian Education," p. 196. "Parts of His Ways," section 4, chapter 8. Physical Geography, see Clouds, Vapors, and Fog.

Suggestions to Teachers.—The pupils will get a very clear idea of how rain is formed by noticing how the steam on wash-day collects on the windows, and also by the sweating of the water pitcher. The steam from the boiler and the wash-tub soon cools, so that they can see what is meant by clouds, fogs, and vapor. The spiritual lessons drawn from the clouds and vapors are simple, but very forcible. The brevity of life is compared to the transitory nature of vapor, and a person who makes a profession, but does not possess Christian love, is like clouds without rain.

LESSON IX.

Why Objects Float or Sink.

1. Which weighs the more, water or air?

2. What is the weight of a column of air one foot square and fifty miles high?

3. What is the weight of a square foot of water one foot (a cubic foot) high? *Ans.*—Sixty-two and one-half pounds.

4. Why do a feather, thistle seed, balloon, and clouds float in the air? *Ans.*—Because they are lighter than the air.

5. Is this the reason why birds fly? (See lesson 6, chapter 3.)

6. Will objects float in water?

7. Place the following objects upon water, and note the results: Cork, dry wood, green wood, beans, an egg, iron, a spoon.

8. How many of these objects sink, and how many float?

9. Why do some sink and others float? *Ans.*—Some are lighter and others are heavier than water.

10. Notice that the cork and the pieces of dry and green wood do not sink the same depth into the water. Why?

11. Why do some of the beans float, while others sink?

12. The egg almost floats. Put the egg into lye or salt water and it will float. Why?

13. If iron will sink, why will not an iron kettle sink when placed right side up on the water?

14. A correct answer to No. 13 will explain how iron can be used to build great ocean steamers, even though it be heavier than water. Why use iron instead of wood? *Ans.*—Because it is much stronger than wood.

15. How can we determine the weight of wood as compared with that of water? *Ans.*—Weigh the wood in the air first. Place a pail in a dish-pan. Fill the pail just level full of water, and completely immerse the piece of wood in the water in the pail. Now weigh the water which ran over into the dish-pan, and divide the weight of the wood in the air by the weight of the water. This simple process will give the specific gravity of all objects lighter than water.

16. How can we determine the specific gravity of objects heavier than water? *Ans.*—First weigh the object in the air, then weigh it in the water. Divide the weight in the air by the difference between the weight in the air and the weight in the water, and the result will show how many times heavier the object is than the water.

17. How does the weight of a fish compare with the weight of water? What enables a fish to come to the surface of the water? Why does a dead fish float?

18. Why did the ax of Elisha's pupil float on the water if iron is heavier than water?

References.—"Parts of His Ways," section 4, chapter 9. Physics, see Specific Gravity.

LESSON X.

The Water of Life.

1. What elements have you studied in the previous lessons which are essential to life? *Ans.*—Light, heat, and air.

2. What are you studying in this chapter that is necessary to life? *Ans.*—Water.

3. What part of God's creation on this earth requires water? *Ans.*—Plants and animals.

4. What is the desire for water called? *Ans.*—Thirst. What causes it?

5. What means has God provided for satisfying thirst? Ps. 104:10-12.

6. Describe a spring, a fountain, and a well.

7. Why is the water in these purer than in lakes, rivers, brooks, etc.?

8. Is water in a well sometimes impure? Why? *Ans.*—

(1) Because of decaying matter which has fallen into it.

(2) Because of surface water from a barn-yard, or from a cesspool, which drains into the well.

9. How may water which contains organic impurities be tested? *Ans.*—

(1) Place the water to be tested in a small, clean bottle; add a pinch of sugar. Place it uncorked in a warm place. If cloudiness appears within two days, the water is too impure to be used.

(2) Dissolve in one ounce of water twelve grains of caustic potash and three grains of permanganate-of-potash crystals. Have the druggist make the solution, putting it in a glass-stoppered bottle. Add two drops of this solu-

tion to one-fourth pint of water. If the pink color changes to brown, or disappears after standing a few hours, the water is impure, and should not be used.

10. How may impure water be made fit to drink? *Ans.*—
    (1) By being distilled.
    (2) By being boiled.
    (3) By being filtered.

11. Describe the filtering process. *Ans.*—Water passes through charcoal, or porous stone, thus separating the impurities from it.

12. Should we not be as careful to have pure water to drink as to have pure air to breathe? Why? *Ans.*—Because many diseases may be traced to impure water.

13. Test the water in your well by following the directions given in No. 9, and see if it be pure.

14. Do pure air and pure water have anything to do with having a pure heart?

15. What does the water we drink, and which helps to sustain our physical lives, represent in the Word of God? *Ans.*—The gospel of Christ, the living water.

16. Should we thirst for this living water?

17. What assurance is given to those who thirst? Matt. 5:6; John 4:13-15; 7:37; Isa. 55:1; Rev. 22:17.

References.—"Principles of True Science;" Air and Water Health Agents, "Testimonies for the Church," No. 32, p. 199; Water, Living, Christ the Giver, "Desire of Ages," pp. 183-187. Physiology, see Water Tests, Healthful Living, Water Drinking, p. 226.

Suggestions to Teachers.—Here is another opportunity to teach the principles of healthful living and to instil into the minds of the pupils that they should be careful to drink pure water, as well as to breathe pure air. Do not fail to show that pure water represents the pure gospel, and that we should thirst for the living water, which gives eternal life, more than for the water which serves our temporal needs only. (Read Ex. 17:1-6; Ps. 78:15, 16; 114:8; 1 Cor. 10:4; John 7:38.)

LESSON XI.

Water as a Cleanser.

1. In the last lesson what did you learn about the value of water?

2. What is thirst? and how is it caused? *Ans.*—It is caused by the water passing from the body through the skin and kidneys.

3. What is the purpose of having the water pass from the body in these ways? *Ans.*—To cleanse it from impurities.

4. As the water passes through the smaller pores of the skin, carrying impurities with it, how is the surface of the body affected? *Ans.*—It becomes covered with these impurities, closing the pores.

5. How may the impurities be removed, so that the poisonous waste matter shall not be retained in the body? *Ans.*—By washing the body with water.

6. What is this method of cleansing the body called? *Ans.*—Bathing.

7. How often should a person bathe? *Ans.*—At least once a week, and once a day is better.

8. Do the lower animals wash their bodies with water?

9. How often do the birds bathe?

10. In what other ways is water used for cleansing? *Ans.*—

(1) In washing our clothing.

(2) In washing dishes.

(3) In cleaning house.

(4) Rain cleanses the atmosphere.

11. Did the Lord give Israel instruction regarding cleanliness of their bodies and of their homes? What was this instruction?

12. Is there any relation between a clean body and a clean soul? *Ans.*—"Cleanliness is next to godliness."

13. What does the Lord use to cleanse the human heart? *Ans.*—The living water. Eze. 36:25. The Word. John 15:3.

14. What should be our daily prayer to the Lord? Ps. 51:10; 19:12.

References.—"Parts of His Ways," section 4, chapter 10.

Suggestions to Teachers.—Here we have another lesson in healthful, physical, and spiritual living. Not only do we need pure water to drink, but also to cleanse the body from impurities within and without. Be careful that you do not simply *teach* these great principles of right living, for they will have but little influence upon your pupils unless you *practise* them. Let your personal appearance be what you desire theirs to be. Let your desk be orderly and well arranged, and this should speak louder than words. The school-room and school-ground should be kept in good order, and the pupils should cooperate in this work.

LESSON XII.

Water as a Medicine.

1. In what way is water used in connection with the body when a person is enjoying good health?

2. Is water, which is so necessary and beneficial in health, helpful in sickness?

3. What is water called when used in restoring health? *Ans.*—Medicine.

4. What are generally used instead of water in treating the sick? *Ans.*—Poisonous drugs.

5. What is the influence of drugs on the human system? *Ans.*—They poison and paralyze it. Read chapter on Drugs in "Healthful Living."

6. How do drugs affect disease? *Ans.*—H. L., p. 243. "Drugs never cure disease; they only change its form and location."

7. What are the remedies which God has provided to cure disease? *Ans.*—Pure air, pure water, bright sunshine, proper exercise, and a clear conscience.

8. What is the influence of water on the system?

(1) When used in drinking? H. L., p. 226.

(2) When used in bathing? H. L., pp. 226-228.

Ans.—

(*a*) It fortifies the body against cold.
(*b*) It improves the circulation.
(*c*) It reduces fever.
(*d*) It makes respiration free and easy.
(*e*) The muscles become more flexible.
(*f*) It soothes the nerves.
(*g*) It promotes perspiration.
(*h*) It promotes digestion.
(*i*) It acts beneficially on the kidneys and urinary organs.
(*j*) It gives new life and energy to the bowels, stomach, and liver.
(*k*) It invigorates the body and mind.

9. Since water does so much for the body, can any one afford not to use it?

10. Can we drink water or take a bath at any time without injuring the body? *Ans.*—"Food should not be washed down; no drink is needed with meals." A bath or a drink of water should not be taken when the body is overheated.

11. How should we eat and drink? 1 Cor. 10:31.

References.—"Principles of True Science;" Water as a Medicine, "Spiritual Gifts," vol. 3, pp. 136, 137. "Parts of His Ways," section 4, chapter 11.

Suggestions to Teachers.—Water, which is so necessary to health, is the medicine which God wants us to use when we are sick. This lesson is not designed to take up the matter of giving water treatments, but simply to call the attention of the pupils to the value of water as a medicine. You may suggest a few treatments, such as placing a wet cloth about the neck for colds, also soaking the feet in hot water to aid in the circulation of the blood. Make all these lessons intensely practical, touching the daily life of your pupils where they need help.

LESSON XIII.

Water-Power.

1. In what three ways have we found water to be beneficial to man? *Ans.*—

(1) It satisfies his thirst.
(2) It removes impurities within the body.
(3) It removes impurities from the outside of the body.

2. In what way is water useful to those engaged in manufacturing? *Ans.*—It furnishes power to run the machinery in manufacturing establishments.

3. In what two conditions is the water when used to propel machinery? *Ans.*—

(1) Liquid water from rivers and ponds turns a water-wheel.
(2) Steam confined in a boiler drives an engine.

4. What is the greatest water-power in the world? *Ans.*—Niagara Falls.

5. How are water-falls produced?

6. Which kind of country is most favorable for obtaining water-power, level or hilly?

7. What part of the United States carries on a great deal of manufacturing through the use of water-power? *Ans.*—New England.

8. Which is the least expensive, steam or water-power? Why?

9. What property of water makes it possible to use it in propelling machinery? *Ans.*—Mobility.

10. How is the wheel constructed and adapted to the water? Draw a water-wheel.

11. What have we already studied which is used to turn

a large wheel? *Ans.*—The air turns the wheel of the windmill.

12. The water turns the wheel, but how does that run the machinery? *Ans.*—By using a belt, which runs from the water-wheel to the machinery.

13. How many kinds of mills can you mention which are run by water-power?

14. What great blessing comes to us through the power of steam. *Ans.*—Rapid traveling. Illustrate.

15. Why did God cause men to make such wonderful inventions in these last days?

16. Does the Word of God speak of an increase in knowledge in the last days? Dan. 12:4.

References.—"Parts of His Ways," section 4, chapter 12. Physics, see Water-wheels.

Suggestions to Teachers.—If you can take the pupils to some mill where water-power is used, it will greatly aid in the understanding of this lesson. If this is impossible, you should make a simple wheel, and run it with water poured from a pitcher. You can connect the wheels by a cord with some spools, and thus show how the power of the water is transferred to the machinery. Encourage the children to make a simple apparatus that will illustrate the different principles that are taught. You can show the power of steam by stopping the spout of a teakettle with a cork and watching the cork as it is thrown out by the pressure of the steam. The steam in the boiler throws forward the arm that moves the wheel of the engine. Show that God has caused these great inventions in order that the gospel may be carried by steamships and railroad trains to all parts of the earth.

LESSON XIV.

The Blessings of Water.

1. Mention some of the many ways in which water is useful. *Ans.*—

(1) As a gas:—

(*a*) It moistens the air.

(*b*) It propels machinery, as is illustrated by the steam-engine.

(*c*) It is used for heating, as is illustrated by steam-pipes.

(2) As a liquid:—

(*a*) It satisfies thirst.

(*b*) It eliminates poison from the body.

(*c*) It aids in the circulation of the blood.

(*d*) It is a cleansing agent, as in bathing and washing.

(*e*) It is necessary to plant and animal growth.

(*f*) It is a dissolving agent.

(*g*) It is a diluting agent.

(*h*) It is used in cooking.

(*i*) It propels machinery, as is illustrated by water-falls.

(*j*) As dew and rain it falls upon the earth, cooling the atmosphere and refreshing the land.

(3) As a solid:—

(*a*) It is a protection to animal life in cold weather.

(*b*) It preserves perishable materials in warm weather.

(*c*) It makes water more palatable in warm weather.

(*d*) As snow it covers the earth, protecting the plants.

2. Which is the most important thing that God made during the first two days, light, heat, air, or water? Why?

Suggestions to Teachers.—This lesson is calculated to be a brief review of all the lessons in this chapter on water. Some of the points may have been omitted and some new ones brought in. In a review of these lessons the pupils will have brought to their minds in a single recitation the great goodness and love of God in creating water and plants, so useful in ministering to the wants of man and animals. The utility of water is greatly increased because it can be changed into so many different forms and conditions. This reveals the great wisdom and love of God. Impress the minds of the pupils with the great

power of God in creating water, His great wisdom in so making it that He can change it into so many different forms and conditions, and His love, in that it satisfies the wants of His creatures.

LESSON XV.

Water as a Symbol.

1. As we enjoy the blessings which come to us through water in its many forms and conditions, what should be the feelings of our hearts? *Ans.*—It should awaken in our hearts feelings of gratitude and thanksgiving.

2. Should we be thankful for all the blessings which surround us? Eph. 5:20.

3. How often should we be thankful? *Id.*

4. To whom should our thanks and praise be rendered? Ps. 34:1; 119:164; 61:8.

5. Do the works of God praise their Creator? Ps. 145:10; 148.

6. What are the greatest blessings that can come to us through the study of water in all its forms and conditions? *Ans.*—The spiritual truths which come to us through water regarded as a symbol.

7. Why are the spiritual of greater value than the temporal blessings? *Ans.*—Because they are eternal, while the temporal blessings minister only to this life.

8. What are some of the spiritual truths symbolized by water in its various forms and conditions? *Ans.*—

(1) Dew. Deut. 32:2; Hosea 14:5; 6:4; Isa. 18:4.
(2) Rain. Ps. 72:6; Prov. 26:1; 28:3; Isa. 55:10; Deut. 32:2; Zech. 10:1; Joel 2:23.
(3) Clouds. Isa. 44:22; Hosea 6:4; 13:3.
(4) Vapor. James 4:14.
(5) Snow. Ps. 51:7; Isa. 1:18; Jer. 18:14.

(6) Water. John 3:5; 4:11-15; Rev. 7:17; 21:6; 22:17.

References.—"Parts of His Ways," section 4, chapter 13. Principles of True Science: Water, Christ the Fountain of Living, "Desire of Ages," p. 454; Well of Water in the Christian, "Testimonies for the Church," No. 33, p. 97.

Suggestions to Teachers.—The previous lesson has brought before the pupils' minds the wonderful blessings of water in this temporal life; now the mind is better prepared to comprehend the wonderful truths which are represented by water as a symbol in the Scriptures. Water is a symbol of life, and therefore is called the water of life. This water of life is the gospel of salvation. As the water brings blessings to us in many forms, so the water of life brings to us blessings unnumbered. The next chapter is entitled "The Dry Land," and will be studied in its relation to water. These two chapters will begin the work usually taken up in elementary geography.

Chapter V.

THE DRY LAND.

(Scripture Basis, Gen. 1:9, 10.)

LESSON I.

"The Dry Land Appeared."

1. Of what two things was the earth composed when it was first created?

2. From what were the land and water made? Heb. 11:3.

3. How were they created? Ps. 33:6, 9.

4. What was the condition of the land and water on the first day? *Ans.*—The land was completely covered with water. Gen. 1:2, 9.

5. How were the waters brought together? *Ans.*—By the power of the word of God.

6. What was the result of the gathering of the waters? *Ans.*—The dry land appeared.

7. What did God call the waters which He had gathered together? *Ans.*—Seas. Gen. 1:10.

8. What did He call the dry land which appeared? *Ans.*—Earth. *Id.*

9. What are the great seas now called?

10. What separates the oceans? *Ans.*—Portions of dry land.

11. Do you think the same portions of dry land are above the water as came up on the third day?

12. Has the dry land ever been covered with water since the third day? *Ans.*—It was covered with water at the time of the flood, in the days of Noah. Gen. 6-8.

13. What are the large portions of dry land called? *Ans.*—Continents.

14. What are the small portions called? *Ans.*—Islands.

15. What are the two halves of the earth called? *Ans.*—Eastern and Western Hemispheres.

16. Name the large bodies of dry land in the Western Hemisphere. *Ans.*—North and South America. The Eastern Hemisphere. *Ans.*—Europe, Asia, Africa, and Australia.

17. Was it hard work for the Lord to lift up the dry land to form continents and islands? Isa. 40:15.

18. Did the Lord design that the water should ever overflow the dry land? Job 38:8-11; Prov. 8:29.

19. What sign has God given that the earth shall not be destroyed again by a flood? Gen. 9:8-17.

References.—"Parts of His Ways," section 5, chapter 1. Geography, see Divisions of Land.

Suggestions to Teachers.—The teacher should have a map of the world to use in teaching the lessons in this chapter, also a map of the United States and of the state in which the pupils live. If none are provided, make these maps upon the blackboard. Above all, the teacher should be provide with a large, shallow box of sand, which will hold water. For busy work the pupils should mould out of the sand the large continents and islands; then use water to represent the oceans. Drawings should be made from these molds instead of from the blackboard. Have a plug in the bottom of the box for removing the water.

LESSON II.

The Earth's Surface.

1. Look out-of-doors and notice the surface of the earth. How does it compare with the floor of the school-room?

2. What do we call those large portions of the earth's surface which are level like a floor? *Ans.*—Valleys, if they are low; plains, if they are high; and plateaus, if they are still higher.

3. What names do we give to elevations of land which are not level? *Ans.*—Low elevations are hills, while the higher elevations are called mountains.

4. Who made the mountains and hills? Isa. 40:12.

5. Did the Lord make mountains and hills of different sizes? *Id.* Why?

6. What makes the mountains and hills so firm and strong? Ps. 95:4.

7. What purposes do the mountains and hills serve? *Ans.*—

(1) They give variety to scenery.
(2) They are a protection against the winds.
(3) They modify the climate.
(4) They form boundary lines between nations.

8. How does the climate in the valleys and plains differ from that on the plateaus, hills, and mountains?

9. What causes the difference of climate? In what way is the difference shown? *Ans.*—By the difference in vegetation.

10. Has the Lord connected the mountains with spiritual things? *Ans.*—

(1) The ark rested on the mountains of Ararat. Gen. 8:4.
(2) The law of God was given on Mount Sinai.
(3) Abraham offered Isaac on Mount Moriah.
(4) Blessings were pronounced on Mount Gerizim and curses on Mount Ebal.
(5) Christ was transfigured upon a mountain.
(6) Mountains were Christ's places of secret devotion.
(7) Christ will descend on Mount Sion. Zech. 14:4.
(8) The redeemed will stand on the Mount of Olives. Rev. 14:1.

11. What spiritual lessons does the Word of God teach through the mountains as symbols? *Ans.*—

(1) The protection of God. Ps. 125:2.
(2) The stability in God. Ps. 125:1.

References.—"Principles of True Science:" Hills, Valleys, Mountains, and Plains in the Beginning, "Spiritual Gifts," vol. 3, p. 33; "Patriarchs and Prophets," p. 44; Mountains Held in Place by God's Power, "Gospel Workers," p. 34; Mountains a Protection, "Great Controversy," p. 635; Mountain and Valley Places for Prayer, "Testimonies for the Church," vol. 4, p. 297. Geography, see Elevation of Land. "Parts of His Ways," section 5, chapter 2.

Suggestions to Teachers.—This lesson takes up the variations of the land surface, and sand should be used in making the hills, mountains, plains, and valleys. If the surrounding country will serve to illustrate this lesson it also should be used. North America should be studied carefully before taking up the other continents. It will be the only continent considered in this series, and will serve to illustrate how the others should be studied. The next lesson will take up the location of mountains, plains, and valleys of North America, also the principal rivers running into the oceans.

LESSON III.

Our Country.

1. What is the name of the continent on which we live? *Ans.*—North America.

2. What is the shape of North America?

3. What ocean is on the east? West? North?

4. What large body of land lies south of North America? *Ans.*—South America.

5. What are the bodies of water called which extend into the land? *Ans.*—Bays, gulfs, and seas.

6. Name some of the bays and gulfs which extend into the coast of North America. *Ans.*—The Gulf of Mexico on the south; the Gulf of Lower California on the west; the Hudson Bay on the north; the Gulf of Newfoundland, Massachusetts Bay, and Chesapeake Bay on the east.

7. Has North America any mountains? Name the two great mountain ranges in North America. *Ans.*—Rocky

9

Mountains in the west, and the Alleghany Mountains in the east.

8. What is the country called which lies between the Rocky and the Alleghany Mountains? *Ans.*—The Mississippi Valley.

9. What great river drains the Mississippi Valley? *Ans.*—The Mississippi River.

10. Into what gulf does it flow?

11. Where does the water in the Mississippi River come from? *Ans.*—It comes from the clouds in the form of rain. The rain falls on the mountains, forming small streams, which unite to form small rivers, and these rivers flow into the great Mississippi, which flows into the Gulf of Mexico, an arm of the Atlantic Ocean.

12. Name other rivers which flow into the ocean. *Ans.*—The Rio Grande River, into the Gulf of Mexico; the Colorado River, into the Gulf of Lower California; the St. Lawrence River, into the Gulf of St. Lawrence; the Potomac River, into Chesapeake Bay.

13. What are the large inland bodies of water called? *Ans.*—Lakes.

14. Name some of the principal lakes in North America. *Ans.*—Lake Michigan, Lake Huron, Lake Erie, Lake Superior, Lake Ontario.

15. Who made all these things which we have studied in this lesson to-day?

References.—Geography, see Map of Western Hemisphere, and Map of North America.

Suggestions to Teachers.—As the different points of this lesson are brought out they should be illustrated on the blackboard. When the pupils see what is meant by a bay, gulf, lake, river, valley, mountain, etc., they should form them with sand and water. They should be able to place all these bodies of water where they belong in the sand continent of North America, and then make a complete drawing thereof. This will give your small pupils "busy work." You will need to take more than one day for this lesson.

LESSON IV.

The Peopling of the Earth.

1. What was God's purpose in causing the dry land to appear? *Ans.*—

(1) To make a garden which would furnish man and the lower animals with food. Gen. 1:29, 30.

(2) To provide a home for man and some of the lower animals. Isa. 45:18.

2. Name some of the common plants that furnish us with food.

3. Mention some of the lower animals which live on the dry land.

4. What two persons did the Lord create to rule over the earth and to inhabit it? *Ans.*—Adam and Eve. Gen. 1:26-28.

5. What took place when the posterity of Adam and Eve were building the Tower of Babel? *Ans.*—Their language was confounded. Gen. 11:1-9.

6. How many languages did the people of the earth speak up to the building of the Tower of Babel? Verses 7, 8.

7. What was the result of confounding their language? *Ans.*—The people could not understand one another's speech. Verse 7.

8. What did the Lord then do? *Ans.*—He scattered them over the face of the earth. Verses 8, 9.

9. Does the Lord have anything to do with locating the nations of the earth and marking off their boundary lines? Acts 17:26.

10. Does the Lord set up kings and overthrow them? Dan. 4:32; 10:20; Jer. 18:7-10.

11. Does the Lord know what kingdoms or nations will live upon the earth long before they are born?

12. What king did the Lord call by name, and tell what he would do, long before he was born? Isa. 45:1-5.

13. Of what great kingdoms did the Lord tell Nebuchadnezzar and Daniel through dreams and visions? *Ans.*—Babylon, Media and Persia, Grecia, and Rome. (Read the second, seventh, and eighth chapters of the book of Daniel.)

14. In which hemisphere did all these nations live? *Ans.*—The Eastern Hemisphere. What nations live there at the present time? Of what great kingdom are they fragments? *Ans.*—Rome.

15. What prophet spoke of these same nations hundreds of years later? *Ans.*—John the Revelator. (Read Revelation 13.)

16. Of what other nation does the prophet John speak? *Ans.*—The United States, under the symbol of a beast which has two horns like a lamb. Rev. 13:11.

17. What is the character of the United States as represented by this beast? Rev. 13:12-18.

18. Where is the United States?

References.—"Parts of His Ways," section 5, chapter 3. Geography, see Map of the World. "Patriarchs and Prophets," chapter 10, The Tower of Babel.

Suggestions to Teachers.—In previous lessons the pupils have seen that it was God's power that formed the hills, mountains, plains, and valleys, but this lesson teaches that His power also controls the nations of the world, and that He determines beforehand the bounds of their kingdoms. The power of God has caused this great nation, the United States, to come into existence, and His Word speaks of it, and the work it will accomplish. The overruling power of God is the main thought in this lesson.

LESSON V.

The Nations of the Earth.

1. Name the great nations which have lived on the earth in the past. *Ans.*—The Egyptians, Israelites, Babylonians, Medo-Persians, Grecians, and Romans.

2. Make a map showing where, in the Old World, these nations lived.

3. What great nations have we in the Old World at the present time? *Ans.*—Those of England, Germany, France, Russia, Austria, Spain, China, Japan, etc.

4. Draw a map showing the location of these nations.

5. What great nations are in the New World? *Ans.*—Those of Canada, the United States, Mexico, Brazil, Argentina, Peru, Ecuador, Bolivia, etc.

6. Draw a map locating these nations, placing Canada, the United States, Mexico, and Central America on your sand continent.

7. In which of these countries do you live? Are these countries composed of smaller divisions? *Ans.*—They are divided into states or provinces.

8. In which state or province do you live? Place it on your map. What states surround it?

9. Is the state divided? *Ans.*—It is composed of many counties. In what county do you live? Place it on your map.

10. Of what is the county composed? *Ans.*—Of townships. How large are they? and how many are there in your county?

11. Why is a country divided into states, counties, and townships? *Ans.*—So that any place may be easily found. This is very convenient in sending mail. When you send a letter, what is placed on the envelope?

12. How many states are there in the United States? Place all of them on your map.

13. When was North America discovered, and by what man? *Ans.*—By Christopher Columbus, in 1492.

14. Where was his home? and how did he reach this country? *Ans.*—His home was in Spain. He came to America on a ship. What ocean did he cross?

References.—"Parts of His Ways," section 5, chapter 4. Geography, use Map of the World, Map of the United States, your state and county maps.

Suggestions to Teachers.—This lesson takes up the principal nations which God has distributed over the earth, and, although they are great and powerful, they are but as a drop in the bucket, and as grasshoppers in His sight. In this lesson the pupils will be able to locate their home, and will begin to see by comparison what a large world they are living in. By dividing it into small divisions the different parts of the country are easily located. In the next lesson we will take up the different methods of traveling from state to state and from country to country. Considerable work is outlined in this lesson, but much of it should be done outside of the recitation as busy work. North America, and especially the United States, should be well worked out with the water and sand, and from this the map should be drawn.

LESSON VI.

Different Modes of Traveling.

1. How large is our earth? *Ans.*—It has a circumference of 25,000 miles, and a diameter of 8,000.

2. What nation lives upon the opposite side of the earth from us? *Ans.*—The Chinese.

3. Are there any Chinese in the United States? What other foreigners can you mention who now have homes in this country? *Ans.*—Japanese, Germans, French, Spanish, etc.

4. How did they come to this country? *Ans.*—By crossing the ocean on ships, steamers, and sailboats.

5. Where did they land in this country? *Ans.*—Either in New York, San Francisco, or some other seaport city.

6. What ocean would be crossed in coming to New York? To San Francisco?

7. How do foreigners go from New York or San Francisco to different parts of the United States? *Ans.*—By traveling on the railroads. How did they travel before the railroads were built? *Ans.*—With teams, in caravans.

8. Can we travel on the cars from the Atlantic to the Pacific Coast? *Ans.*—Three railroad lines unite these coasts, the Northern Pacific, Union Pacific, and Southern Pacific. Place these three railway lines upon your map.

9. Does a railroad pass near your home? What places does it connect?

10. What are those places called which have only a few hundred inhabitants? *Ans.*—Towns. What are they called when they contain thousands of inhabitants? *Ans.*—Cities.

11. What is the name of the largest city in your state? Place it on your map.

12. What are those cities called in which the laws are made? *Ans.*—Capitals. Name the capital of your state. Of the United States.

13. What other means have we of traveling from town to town, and from city to city, in the United States? *Ans.*—Small steamboats for traveling up and down the large rivers and on the lakes. Name some of these rivers and lakes. *Ans.*—The Mississippi, Columbia, St. Lawrence, and the five Great Lakes.

14. What furnishes the power to run all these trains, steamers, etc.? *Ans.*—Steam.

15. Who caused these many ways of rapid traveling to be invented? Dan. 12:4. For what purpose? *Ans.*—That the last message of salvation may be carried to the world in a very short time.

References.—"Parts of His Ways," section 5, chapter 5. Geography, use railroad and steamship maps.

Suggestions to Teachers.—The last sentence contains the all-important thought in this lesson. In Nahum 2:4, 5, the swift chariots of God are spoken of; and they run like the lightning. This is to take place in the day of God's preparation, when He is preparing a people who will be translated when He comes the second time.

LESSON VII.

The Earth's Rocky Frame.

1. What is that part of a house called which makes it strong and firm? *Ans.*—The frame.

2. What gives strength and solidity to the human body? *Ans.*—The bones.

3. What gives strength and solidity to the earth, as do the bones to the body? *Ans.*—The rocks.

4. Were rocks made when God created the earth? P. P., p. 44.

5. Are the rocks the same now as then? *Id.*

6. What is the nature of rocks?

7. Name some of the common rocks, and tell in what ways they are useful? *Ans.*—

(1) Quartz rock. Sand, flint, etc., are familiar examples. Glassware and window-glass are made from quartz.

(2) Silicate rock. The mica in this rock is used in stoves, that the light of the fire may shine through. It is then called isinglass. Silicate rock is used in making asbestos mats. Isinglass and asbestos will not burn, neither will they melt.

(3) Limestone rock. Common limestone is found in large beds. It is made into lime by burning, and is used as mortar in building stone walls, and as plaster on the walls and ceilings of houses.

(4) Coal rock. Coal is very abundant, forming large beds beneath the surface of the earth. It is used for fuel.

(5) Salt rock. Large quarries of salt are found beneath the surface of the earth. It is used for preserving and for seasoning foods.

(6) Iron rock. Large beds of iron rock are found under the earth's surface. It is useful in making machinery, stoves, cooking utensils, etc.

8. How is the coal taken out of the earth? Salt? Iron?

9. What is done with iron ore after it is taken from the earth? *Ans.*—It is melted, and the pure iron is separated from the other elements in the rock. The melted iron is then run into molds. When it cools, it is broken into short sticks called "pig-iron."

10. Visit a lime-kiln, and learn how the limestone is taken from the quarry and prepared for the market.

11. Who is spoken of as a rock in the Scriptures? *Ans.*—Christ. Why?

12. Of what is rock a symbol in the Bible?

References.—"Principles of True Science:" Rocks Not Bare in the Beginning, "Spiritual Gifts," vol. 3, p. 35; "Patriarchs and Prophets," p. 44; Rocks and Mountains Made by God, "Special Testimonies on Education," p. 58; "Testimonies for the Church," vol. 4, p. 297; Rock, Water from, "Spiritual Gifts," vol. 4, pp. 38, 39; Rock and Character, "Mount of Blessing," pp. 201, 202. "Parts of His Ways," section 5, chapter 6. Geology, see Quartz, Silicates, Limestone, Coal, Salt, and Iron.

Suggestions to Teachers.—The previous lessons have taken up the study of the surface of the earth, but now we begin to study the conditions and structure of the earth beneath the surface. The rocks form the beams or pillars which give strength and solidity to the earth. Ps. 104:3; Job 9:6. If the school is located near a mine or quarry, the pupil should visit it, as seeing is better than hearing only.

LESSON VIII.

The Rock-Makers.

1. What two kinds of coal do we burn in our stoves? *Ans.*—Anthracite, or hard coal, and bituminous, or soft coal.

2. From what is coal made? Examine a piece of soft coal, and you will see that it looks like a piece of black wood. *Ans.*—It was made from herbs and trees.

3. When and how was it made? *Ans.*—At the time of the flood, by covering the dense vegetation with water, mud, and earth. P. P., p. 108.

4. Are trees being turned to coal and rock at the present time? *Ans.*—Agate and opal are petrified trees. Peat is a form of coal made in the low marshes. Little boat-shaped microscopic plants, called "diatoms," form rock. These plants live in the water of ponds and lakes. When the ponds and lakes dry up, the glassy skeletons of these plants help to make the rock or soil of the earth.

5. What besides plants form rock? *Ans.*—Animals.

6. Name some of the rock-making animals. *Ans.*—

   (1) The sponges; their skeletons form quartz rock.
   (2) The rhizopods; small animals whose minute skeletons form limestone.
   (3) The corals; their skeletons form coral islands.
   (4) The clam and oyster shells; these also help to form limestone rock.

7. When do the shells of these animals help to make rock? *Ans.*—When the animals die, their skeletons drop to the bottom of the pond, lake, or ocean, and form a layer on the bottom. If these ponds or lakes dry up, then the skeletons form into rock.

8. Where do these creatures get the material to form their limestone shells? *Ans.*—They extract it from the water in which they live.

9. How can we tell limestone from other stones? *Ans.*—Place two or three drops of hydrochloric acid on the stone to be tested. If the acid forms into bubbles, then you have a piece of limestone.

10. What is marble? *Ans.*—It is limestone which has changed to a crystalline structure.

11. For what purposes is marble used? *Ans.*—For monuments and for floors.

12. Find some limestone with shells of animals in it. What kind of shells do you find?

References.—"Parts of His Ways," section 5, chapter 7. Geology, see Peat, Diatoms, Rhizopods, Corals, and Mollusca.

Suggestions to Teachers.—The Creator formed different kinds of rock in the beginning, but they are constantly being destroyed, so the Lord has provided ways whereby they may be constantly renewed. This is brought about by the death of plants and animals. The teacher can show the wisdom and love of God in making the earth a treasure-house which contains those things which minister to our comfort and happiness.

LESSON IX.

The Rock Destroyers.

1. What is the difference between a rock and a bed of sand? *Ans.*—In a rock the small particles cling together, while the particles of sand do not.

2. Does a sand bed ever form into solid rock? *Ans.*—We have rock called sandstone.

3. How may the particles of rock be separated from one another? *Ans.*—By breaking and crushing the rock.

4. What are the natural means for causing rocks to crumble and wear away? *Ans.*—

(1) Water. Go down to the brook or the beach, and notice the stones. They are worn smooth by the action of water on their surface.

(2) Frozen water. Water fills the cracks and crevices of the rocks, then, freezing, breaks the rocks open. Explain why frozen water splits the rock into pieces.

(3) Cold and heat cause freezing and thawing, which loosen the particles, causing the rocks to crumble.

(4) Air causes a crumbling through the action of strong winds.

5. How do coral islands which are composed of solid rock become covered with vegetation? *Ans.*—The action of water, heat, and cold causes the coral rock to crumble, thus becoming soil for seed which may be washed ashore by the waves or be borne hence by the winds.

6. What will happen to the rocks when Christ comes to gather the righteous? Rev. 6:15, 16.

7. What will be the cry of the wicked? *Id.*

8. What holds the little particles of rock together? Col. 1:16, 17. What caused the walls of Jericho to stand? To fall?

9. What power will keep us from falling? Jude 24. But what must we do before we shall be able to stand? Matt. 21:44. What will happen if we do not fall upon the Rock? *Id.*

References.—"Parts of His Ways," section 5, chapter 8. Geology, see Erosion.

Suggestions to Teachers.—By the power of God all things consist,—hold together. His power gives to the rocks, hills, and mountains their strength. Smooth pebbles, sand, crumbling rocks, should be used to illustrate this lesson. A visit to some beach or to some rocks will add much to its interest. The grains of sand are produced by the action of water and the rubbing of rocks and stones against each other. This lesson teaches some of God's ways of breaking up rocks and stones into small particles so that they can be taken up by the plants. When the plants die, they turn back to dust, and make rich, black soil on the surface of the earth. The enduring rock is a fit symbol of the Rock Jesus Christ, the same yesterday, to-day, and forever.

LESSON X.

The Earth a Treasure-House.

1. Why did God create the earth?

2. Why was the dry land caused to appear above the water?

3. Does the dry land serve any other purpose than that of making a home for man and the lower animals? *Ans.*—It is a treasure-house, containing many things necessary for man's comfort and convenience.

4. Name some of the treasures which the earth contains, and tell us in what ways they are useful. *Ans.*—

(1) Iron ores. Iron is taken out of the earth, and is used in making machinery and iron wares of various kinds. Job 28:2.

(2) Coal. Coal is the buried remains of vegetation which flourished before the flood. It is useful for fuel.

(3) Copper. It is molten out of stone. Job 28:2. It is made into wires, which form good conductors of electricity. It is used in making machinery, etc.

(4) Tin. Tin is useful in making household utensils, used for cooking, etc.

(5) Lead. It is used in making paints.

(6) Silver. It is used as money, in making silverware and other articles.

(7) Gold. It is used for money, and for gilding books, etc.

(8) Limestone. It is used for building purposes.

(9) Rocks. Many kinds of rocks are used in laying the foundations for buildings.

(10) Clay. It is used by potters in making vases and pottery. It is also used in making brick.

(11) Precious stones. They are used for ornamentation.

5. How are gold and silver deposited in the earth? *Ans.*—In veins. Job 28:1.

6. Did the earth contain gold, silver, and precious stones before Adam and Eve sinned? Gen. 2:11, 12.

7. Were the precious metals and stones beneath the surface of the earth in the beginning? P. P., p. 90.

8. When and where were they buried? Why? P. P., p. 109.

9. What was God's purpose in creating gold, silver, precious stones, iron, lead, tin, etc.?

10. What lesson may we learn from the way the antediluvians used these treasures of the earth? P. P., p. 90.

References.—"Parts of His Ways," section 5, chapter 9. Geology, Gold, Silver, Copper, Tin, Lead, Clay.

Suggestions to Teachers.—In this lesson the pupils will see that David spoke the truth when he said, "The earth is full of Thy riches." Ps. 104:24. As far as possible have the above-named specimens for illustration in the class recitation. Gold, silver, and precious stones were on the surface of the earth before the flood, but the people used them for their own selfish purposes, so God had to cover them up. Now we have to dig them out of the earth, so that it takes much hard work to procure them. If you have a brick or lime-kiln or mines near your school, you should take the pupils to them, and explain how they are operated. God's love, wisdom, and power are plainly seen in the treasures He has placed in the earth for the use of man.

LESSON XI.

The Alphabet of Matter.

1. Do we find gold, silver, lead, iron, tin, etc., in a pure state in the earth? *Ans.*—They are very rarely found in a pure state. Iron is usually found in combination with either sulphur (iron pyrite), or oxygen (hematite and magnetite).

Lead is found with sulphur (galenite). Silver is found with sulphur and antimony (argentite). Gold is found in quartz, which consists of silicon and oxygen.

2. What do chemists call these substances, gold, silver, iron, lead, copper, tin, sulphur, oxygen, silicon, hydrogen, nitrogen, etc.? *Ans.*—Elements.

3. What is an element? *Ans.*—A substance which can not be divided by chemists into anything else. For example: Iron can not by any known chemical process be changed into anything but iron. So it is with the elements, gold, silver, lead, tin, oxygen, hydrogen, sulphur, silicon, etc. Recently chemists have found an element in combination with nitrogen. It is called argon.

4. How many elements have been discovered up to the present time? *Ans.*—About seventy.

5. For what purpose did the Lord, the great Chemist, make the seventy elements? *Ans.*—By combining the various elements in different proportions, the great variety of combinations which we see about us are made.

6. What are these combinations called? *Ans.*—Compounds.

7. Name some of the most familiar compounds, and give the names of the elements composing them. *Ans.*—

(1) Water, consisting of hydrogen and oxygen.
(2) Salt, consisting of sodium and chlorine.
(3) Air, consisting of oxygen and nitrogen.
(4) Carbon-dioxid, consisting of carbon and oxygen.
(5) Sugar, consisting of carbon, hydrogen, and oxygen.
(6) Alcohol, starch, and many other compounds consist of carbon, hydrogen, and oxygen, but the elements are combined in different proportions.

8. What familiar illustration can be used to make more plain the combinations of the elements? *Ans.*—The alphabet.

The twenty-six letters are the elements of the English language. The words are the different compounds. Just as the letters make the words, and the words form the sentences, and the sentences make our English language, so the elements form the mineral compounds, and the minerals form the rocks, and the rocks form the dry land.

9. Name all the compounds which you see about you in nature. Do any of them look alike?

10. What does this great variety of form, color, structure, and composition, teach us about the great Chemist?

References.—"Parts of His Ways," section 5, chapter 10. Chemistry, see Elements.

Suggestions to Teachers.—You can use the symbols of the elements when you wish to illustrate the compounds with the alphabet and words. For example, the letters C and O stand for carbon and oxygen. The letters T and O spell TO in language, so C and O spell CO, carbon monoxid, in chemistry. T, O, and O spell TOO, which has a different meaning than TO. So C, O, and O spell COO, carbon dioxid, which is a different substance from CO, carbon monoxid. Dwell particularly upon the thought of the great wisdom of God in making so many compounds, and His wonderful love in adapting them to our needs.

LESSON XII.

The Metals and Non-Metals.

1. Examine carefully pieces of gold, silver, iron, tin, lead, copper, zinc, sulphur, silicon, and phosphorus, and describe each one as to its general appearance.

2. What do we call those elements which have a bright luster? *Ans.*—Metals.

3. What are those called which have no luster? *Ans.*—Non-metals.

4. Which of the elements mentioned in No. 1 are metallic? Non-metallic?

5. Look into a new tin dish. What do you see? Why?

6. Why do the surfaces of metals look so bright? *Ans.*—Because they reflect so much of the light.

7. What metal is used in the looking-glass to reflect the light?

8. Break a piece of iron. How does the broken surface compare with the remaining surface? *Ans.*—It is much brighter.

9. What is the color of the unbroken surface of the iron? Will the broken surface finally take the same color? What causes the change of color? *Ans.*—The oxygen of the air unites with the iron.

10. Why does a white house look yellow after a time? *Ans.*—The oxygen of the air unites with the lead in the paint, turning it yellow.

11. Name the different metals which are spoken of in the Bible.

12. What was the name of the first metallurgist, as recorded in Gen. 4:22?

13. For what purposes were different metals used in Bible times? (Study the tabernacle of Moses and the temple of Solomon, with their furniture.)

14. Of what were the temple and tabernacle a pattern? *Ans.*—Of the temple in heaven.

15. Is there gold in heaven? For what purpose is it used? *Ans.*—It is used for harps of gold and crowns of gold. Rev. 4:4, 10; 5:8.

16. What do the different metals symbolize? *Ans.*—

(1) Gold and silver represent pure and tried character. 1 Cor. 3:12, 13; Job 23:10; Rev. 3:18; 1 Peter 1:7; Mal. 3:2, 3.

(2) Iron, brass, tin, lead, etc., represent imperfect character and instability. Isa. 1:25; Eze. 22:18-20.

17. Why will a golden crown and a golden harp be a fitting gift for the Lord to bestow upon the redeemed? 2 Tim. 4:8; Rev. 3:11; 14:1, 2; 15:2.

References.—"Principles of True Science:" See Gold, Silver, and Iron. Chemistry, see Metallic and Non-Metallic Substances. "Parts of His Ways," section 5, chapter 11.

Suggestions to Teachers.—The Word of God takes gold,—the most precious of the metals,—to represent that which is most precious in the sight of God,—character. The Lord says, "I will make a man more precious than fine gold." Isa. 13:12. So to the Laodicean church came the message, "I counsel thee to buy of Me gold tried in the fire, that thou mayest be rich." As the heat of the furnace purifies the gold and silver, so God's people are purified in the furnace of affliction. We are not to seek for gold, but for pure character. If this is secured, then we shall have a golden crown, a golden harp, and a home in a city whose streets are paved with pure gold. Rev. 21:18, 21. Sulphur or brimstone, one of the non-metallic elements, God will use to destroy all those who have failed to perfect righteous character. Rev. 21:8; 14:9-11.

LESSON XIII.

The Precious Stones.

1. What is the difference between a rock and a stone? *Ans.*—Rocks are much larger than stones. Stones are fragments of rocks, worn more or less smooth by the action of water, heat, and air. Job 14:19.

2. What are very small stones called? *Ans.*—Pebbles. What is a gravel bed?

3. Have the small stones in a gravel bed or on a beach different colors? Why? (Review lesson 4, chapter 2.) *Ans.*—Because different stones reflect different colors of light.

4. What are the stones which sparkle, and those which have beautiful colors, called? *Ans.*—Precious stones.

5. Name some of the precious stones with which you are acquainted.

6. Did the Lord place precious stones in the earth when He created it? Gen. 2:12.

7. Where does man find the precious stones? Why did God cover them up? P. P., pp. 90, 108.

8. Name the precious stones of the Bible. Ex. 28:17-20; Eze. 28:13; Rev. 21:19, 20.

9. What are the nature and composition of the precious stones? *Ans.*—They are very hard, and are melted and dissolved with great difficulty, on account of being composed largely of silicon, a very enduring element.

10. Describe the arrangement of the stones upon the breastplate of the high priest. What was the significance of the stones as used in the breastplate? *Ans.*—The names of the twelve tribes of Israel, graven in the enduring stone, signified God's enduring love and remembrance of Israel.

11. What stones adorned the garments of Lucifer? Eze. 28:13.

12. How are the precious stones used in the city of New Jerusalem? Of what does each gate consist? Rev. 21:21.

13. What do the precious stones symbolize? *Ans.*—1 Cor. 3:13. Character.

14. Which is of the greater value, the precious stones or the character which is formed by the wisdom which God gives? Job 28:12-19, 28.

15. What will God give to all those who have perfected righteous characters? Rev. 2:17.

References.—"Principles of True Science:" See Stones. "Parts of His Ways," section 5, chapter 12. Geology and Mineralogy, see Precious Stones.

Suggestions to Teachers.—We are to be living stones in God's spiritual temple. The foundation of this temple is the apostles and prophets, Jesus Christ being the chief corner-stone. In this life we are being hewed, squared, polished, and fitted for a place in this great temple. Eph. 2:19-22. Christ is spoken of in the Word as a Precious Stone, elect, and all who do not accept Him are called stones of stumbling. This lesson brings forth the value which God places on character, and none shall enter the city whose foundations are garnished with all manner of precious stones, and whose gates are single pearls, unless they have the character which the precious metals and stones represent. Rev. 21:19-21.

LESSON XIV.

The Conditions of Matter.

1. What do we call that from which everything is made? *Ans.*—Matter.

2. What is matter? *Ans.*—It is anything which occupies space, or has weight.

3. Has matter always existed, or did God create it? *Ans.*—He created it. Heb. 11:3; Rom. 4:17; 1 Cor. 1:28; Ps. 33:6, 9.

4. Can God, who created matter, destroy it?

5. Can man destroy matter? If you burn a stick of wood, is the matter destroyed, or only the wood?

6. What becomes of the stick of wood? *Ans.*—Part of it passes off as smoke, steam, and carbon-dioxid gas, while the remainder is reduced to ashes.

7. Should all the smoke, steam, carbon-dioxid, and ashes be collected and weighed, how would their combined weight compare with the weight of the wood? *Ans.*—It would be the same.

8. In how many conditions do we find matter? *Ans.*—Three.

9. Name these conditions, with examples of each. *Ans.*—

(1) Gas; air, oxygen, hydrogen, nitrogen, steam, etc., are examples.

(2) Liquid; water, milk, vinegar, kerosene, etc., are examples.

(3) Solid; wood, iron, rocks, ice, beeswax, copper, etc., are examples.

10. Can air and steam be changed to other conditions? *Ans.*—Air can be changed into a liquid, while steam can be changed into both a liquid and a solid.

11. Can the liquids above mentioned be changed to other conditions? *Ans.*—All of them can be changed to both the gaseous and solid conditions.

12. Can solid rock, iron, copper, and beeswax be changed? *Ans.*—All of them can be melted so that they will flow in streams.

13. How are these changes from one condition to another brought about? *Ans.*—By heat, cold, and pressure.

14. What great changes will the earth undergo when this earth is purified by fire? 2 Peter 3:10-12.

References.—"Principles of True Science:" See Matter. "Parts of His Ways," section 5, chapter 13. Physics and Chemistry, see Conditions of Matter.

Suggestions to Teachers.—The word of God is able to make something out of nothing. It has power not only to create, but to destroy; also to change the conditions of matter. The different forms of energy,—light, heat, magnetism, and electricity,—are but different manifestations of the great power of God; "for there is no power but of God." Rom. 13:1; Ps. 62:11. Then it is plain that it is God's power which changes matter from a gaseous to a liquid condition, from a liquid to a solid, from a solid to a liquid, and from a liquid to a gas. God permits us to use this power for this purpose when we change the conditions of matter. How near the Lord is to all His creatures in the daily manifestations of nature! The pupils should become acquainted with the three conditions of matter and their transformations, by simple experiments.

LESSON XV.

The Nature of Matter.

1. What is matter? How do we recognize the material things about us? *Ans.*—Through one or more of the five senses,—sight, smell, taste, touch, and hearing.

2. As we study the common objects about us we learn the following facts:—

(1) That *all* matter is:—

(*a*) Divisible. We can break a stone into small pieces. When the parts can be seen by the naked eye they are called masses. When too small to be seen, they are called molecules. Those very small particles which compose the molecule are called atoms.

(*b*) Impenetrable. No two masses, molecules, or atoms can occupy the same space at the same time. Two books, balls, etc., can not be in the same place at the same time.

(*c*) Indestructible. Matter can not be destroyed by man. The disappearing snow and ice are not destroyed, but changed only, into water and vapor.

(2) That *some* matter is:—

(*a*) Malleable. It can be pounded out into thin sheets. Examples: Gold, lead, and iron.

(*b*) Brittle. It will break up into small pieces when pounded with a hammer. Examples: Glass, rocks, stones.

(*c*) Ductile. It can be drawn out into wires, as can iron and copper.

(*d*) Hard. It can not be easily scratched with a nail or sharp-pointed instrument, as is the case with glass, diamond, and quartz.

(*e*) Soft. It can be easily scratched, as can lead, gold, beeswax.

3. Who made all kinds of matter? and who causes it to consist, or to stick together? Col. 1:16, 17.

4. What do scientists call this power which causes particles of the same kind to cling together? *Ans.*—Cohesion. Give examples. *Ans.*—Rubber, rocks, wood, etc.

5. What is the power called which causes unlike particles of matter to stick together? *Ans.*—Adhesion. Give exam-

ples. *Ans.*—Glue sticks to wood; cements hold broken pieces of glass and chinaware together.

6. Whose power is it which holds our bodies together? Acts 17:28.

7. Should this power which holds things together be removed, what would happen?

8. Why did God give to matter all the different properties mentioned in this lesson? *Ans.*—So that it might be adapted to our needs.

References.—"Principles of True Science:" Matter Does Not Possess Vital Power; "Patriarchs and Prophets," p. 114; "Christian Education," p. 194; Nature's Qualities and Powers Imparted by Christ, "Christ's Object Lessons," p. 18. Physics and Chemistry, see Properties in Matter. "Parts of His Ways," section 5, chapter 14.

Suggestions to Teachers.—In this lesson as you study the properties of the different kinds of matter show that they are so made that they may best serve the purposes for which they were created. The different metals are not constituted alike, but each one has just the properties it needs to do its appointed work. So it is with us, each one of us has an individuality of his own which fits him for the work God has appointed him to do.

LESSON XVI.

The Love and Hate of the Atoms.

1. How many divisions of matter are there? Name them. *Ans.*—Mass, molecule, and atom.

2. What is a mass? A molecule? An atom?

3. When the atoms and molecules so love each other that they cling tightly together, what is formed? *Ans.*—A solid.

4. When they do not cling tightly, what is formed? *Ans.*—A liquid.

5. When they so hate each other that they will not stay close together, what is formed? *Ans.*—A gas.

6. Give examples which will illustrate the love and the hate of the atoms and molecules. *Ans.*—

(1) A nail left outdoors in a damp place will soon rust. This is caused by the little atoms of oxygen in the air being attracted to the iron composing the nail.

(2) The fire in the stove is caused by atoms of oxygen in the air having an attraction, or love, for the atoms of carbon in the wood. What is formed by this union of oxygen and carbon?

(3) Open a bottle of ammonia water and notice the results. Why is the room filled with the odor of ammonia? *Ans.*—Because the molecules of ammonia hate each other so much that they they will not remain together in the bottle.

(4) Bring an orange into the room and notice how its fragrance fills the entire space. Open a can of kerosene oil and note the results.

7. Obtain from the druggist a little powdered sulphur and powdered potassium chlorate. Mix a small pinch of these two powders together, and place this mixture upon an anvil or some smooth metal surface; then rub it with the back of an ax, or the head of a hammer. What is the result?

8. Take a small piece of phosphorus and powdered sulphur and wrap them in a small piece of tissue paper. The whole amount should be about the size of a pea. Place this little packet on an anvil or metal surface, and strike it a quick blow with a hammer. What is the result?

9. What causes the explosions which take place in Nos. 7 and 8? What causes the sharp explosion which takes place when the trigger of a little toy pistol comes down on the thin paper cap?

10. Take a tablespoonful each of powdered potassium chlorate and powdered loaf-sugar, and mix them thoroughly.

Spread this mixture out very thin on an old plate. Bring a drop of sulphuric acid just as near to the mixture as possible without touching it. What takes place? Now let a drop of the acid fall upon the mixture. The experiments in Nos. 7-10 have one principle which causes the explosions and combustion. What is it?

References.—"Principles of True Science:" See Atom. "Parts of His Ways," section 5, chapter 15. Chemistry, see Atom, Mass, Molecule.

Suggestions to Teachers.—This lesson illustrates how the molecules and atoms of matter are attracted and repelled. The small atoms of sulphur and potassium chlorate have an attraction for each other, just as the stars have a mutual attraction. But this attractive power acts only at a very short distance, so it is necessary to push the atoms near to each other before they will rush together. This is what was done in the above experiments. Dip a piece of zinc into sulphuric acid. Notice carefully how the water seems to boil upon the surface of the zinc. This is caused by the atoms of the zinc and sulphuric acid rushing together. All these experiments are exhibitions of the power of God. Do not fail to perform some of these experiments, even if you can not perform all of them. Read Judges 6:19-24; 1 Kings 18:21-39.

LESSON XVII.

Mixtures and Compounds.

1. How were the atoms of the different substances brought together in the experiments of the last lesson? *Ans.*—They were pushed together until they were close enough to be attracted by each other.

2. When the sulphur and potassium chlorate came together with an explosion, did they remain unchanged? *Ans.*—They formed a new substance, thus changing the form of the sulphur and potassium chlorate.

3. What would you call the sulphur and potassium chlorate before they were united by the explosion? *Ans.*—A mechanical mixture. What afterward? *Ans.*—A chemical compound.

4. Give familiar examples of mechanical mixtures. *Ans.*—The atmosphere, sugar and salt, salt and water, flour and alum, iron-filings and sulphur.

5. Give familiar examples of chemical compounds. *Ans.*—Water, salt, sugar.

6. Can we make a mechanical mixture and then change it to a chemical compound? Take some iron-filings and mix them with sulphur. This would be a mechanical mixture, for the little particles of iron and sulphur remain unchanged, and can be separated by passing a magnet through the mixture. Now heat the mixture; it will change to a liquid. Let the liquid cool. After it has cooled sufficiently, crush it to a fine powder. Now try to separate the sulphur and iron with the magnet as before. Examine the powder with a magnifying glass. Can you discover small particles of sulphur and iron? The small atoms of iron and sulphur have combined so that the identity of the iron and sulphur is lost. This was brought about by heat, and has changed the iron and sulphur from a mechanical mixture to a chemical compound.

7. In what two ways have you found that a mixture can be changed to a compound? *Ans.*—By pressure and by heat.

8. Can any of the compounds be separated into their elements? *Ans.*—Water can be separated into oxygen and hydrogen by passing electricity through it. (See lesson 3, chapter 4.) Mercuric oxid can be separated into mercury and oxygen by heating a little of the red powder in a bottle. The mercury will adhere to the sides, while the oxygen will escape as a gas. Test the oxygen with a lighted splinter.

9. When man studies the elements and compounds, and finds how they are put together in the earth, whose ways and thoughts is he studying?

References.—"Parts of His Ways," section 5, chapter 16. Chemistry, see Mechanical Mixtures and Chemical Compounds.

Suggestions to Teachers.—This lesson is a continuation of the preceding, only carrying the experimental work a little further. Your

pupils may not grasp all there is in the lesson, but they will get something which will create in their minds a desire to learn more of the ways of God. These experiments are very simple, and can be easily worked if you have the materials.

LESSON XVIII.

Soils of the Earth.

1. As one digs down into the earth, what does he notice as to its structure? *Ans.*—That the crust of the earth is arranged in layers.

2. Of what are these layers composed? *Ans.*—Of black soil, clay, sand, gravel, etc.

3. In what order are they found where the ground is fertile? *Ans.*—(1) Black soil. (2) Clay. (3) Sand. (4) Gravel. (5) Rock.

4. What is the surface layer of the dry land called? *Ans.*—Soil.

5. Name the different kinds of soil. *Ans.*—Black soil, clay soil, sandy soil, etc.

6. Which soil is the most fertile? *Ans.*—The black soil usually yields the largest crops, but different kinds of vegetation require different soils.

7. What kind of soil is the best for wheat? Corn? Beans? Potatoes? Why? Why do these plants grow more rapidly at first in sandy soil? Why are not the later stages of growth as luxurious?

8. What portions of the world are unproductive? *Ans.*—The deserts.

9. Where are they located? and what kind of soil have they? *Ans.*—The Desert of the Great Plains is in the southwestern part of the United States, and the Great Sahara Desert is in Central Africa. The soil is sandy.

10. Is the lack of vegetation caused by a scarcity of rain, or by the poor quality of the soil?

11. Will the time ever come when the deserts and the waste places will produce vegetation? Isa. 35:1, 2, 7.

12. What is the cause of the barrenness of the earth? Gen. 3:17-19; 4:9-12.

13. Is it the duty of farmers to till the soil carefully, so that it may not only retain its strength but even grow stronger?

14. Was Adam a farmer? Gen. 3:23. Did any of his sons follow the same occupation? Gen. 4:2, 3.

15. Will the Lord bless men with good crops if they will farm to His glory? Sp. T. Ed., pp. 89, 95, 102-105.

16. Of what is soil a symbol? Matt. 13:3-8, 18-24.

References.—"Principles of True Science:" Soils, Cultivation, Good for Children, "Special Testimonies on Education," p. 60; Soil preparation, unpublished Testimonies; Soil Tilling the Most Beneficial Labor, unpublished Testimonies; Soil Restoration, "Christ's Object Lessons," p. 289; Soil, Farmers Should Gather Spiritual Lessons from, "Christ's Object Lessons," p. 88. "Parts of His Ways," section 5, chapter 17. Text-book on Agriculture, see Soils.

Suggestions to Teachers.—If you can take the students to some place where a cellar or well is being dug, they will understand this lesson much better. Have them collect in small boxes all the different kinds of soil they can find, and label the boxes with the names of the soil. Impress on the pupils' minds that tilling the soil is a noble occupation; that farming will be carried on in the new earth, where the curse will be removed. Isa. 65:17-22. God has promised to bless those who will farm to His glory, by removing those things that destroy the crops. Mal. 3:8-12; Joel 2:21-27.

LESSON XIX.

The Purpose of the Dry Land.

1. What was the condition of the earth when it was first created? Gen. 1:2.

2. Was God satisfied to leave it in this unfinished condition? Isa. 45:18.

3. What did the Creator do that the earth might be inhabited? *Ans.*—He caused the dry land to appear.

4. On what day did it appear? *Ans.*—On the third day.

5. What purposes does the dry land, the solid portions of the earth, serve? *Ans.*—

(1) It furnishes a home for man, and for many of the lower animals.

(2) It is a treasure-house containing gold, silver, and precious stones.

(3) It contains stones and rocks, which are used for building purposes.

(4) It contains metals, which are used for making all kinds of machinery and many useful utensils.

(5) It forms, through the solid rocks, the framework, or bones, which give strength and solidity to the earth.

(6) Lastly, and yet of great importance, are the soils, which produce all kinds of plants, which serve as food for the lower animals, and for man.

6. What did God create before He caused the dry land to appear? Gen. 1:3-8. *Ans.*—Light, heat, and air.

7. What results were immediately brought about by creating light, heat, and air? *Ans.*—The water which covered the earth was transformed into vapors, and lifted by the air above the earth. The winds, produced by heat, carried the clouds about in the firmament.

8. What was God's purpose in taking the water up into the air in the form of clouds? *Ans.*—That He might water the plants which He was soon to cause to spring out of the dry land.

9. What did God do after the water system was perfected, and the dry land appeared? *Ans.*—He created the plants.

Suggestions to Teachers.—This lesson brings us to the study of plants, which were created on the third day. All the work previously done by the Creator was simply preparatory to this work of creating

vegetable life. When the plants came into existence, the light, heat, air, water, and soil were the means necessary to maintain their growth and development. Now as the pupils take up the study of plant life, they should perceive the relations existing between the forces light and heat; the substances air, water, soil; and the plants themselves. Review briefly the lessons on Light, Heat, Air, Water, and the Dry Land, as this will prepare the student to take up the study of Plants to much better advantage.

Chapter VI.

PLANTS.

(Scripture Basis, Gen. 1 : 11–13.)

LESSON I.

The Creation of Plants.

1. Name the things which you have studied thus far in God's creation.

2. What did God create on the first day? On the second day?

3. What was the first work done on the third day? For what did this prepare the way? *Ans.*—For the creation of plants.

4. Who created the plants? Gen. 1 :11.

5. How did He create them? *Ans.*—By His word. *Id.*

6. From what were the plants made? *Ans.*—From the soil, or dust of the earth. *Id.* Gen. 2 : 9.

7. What classes of plants did the Lord create? *Ans.*—Grass, herbs, and trees. Gen. 1 : 11.

8. Give examples of these three classes of plants. *Ans.*—
   (1) Of grass: Wheat, oats, barley, timothy, etc.
   (2) Of herbs: The gooseberry, currant, lilac, etc.
   (3) Of trees: The oak, maple, elm, ash, etc.

9. How did the Lord arrange so that new generations of plants might be produced? *Ans.*—He caused the plants to produce seed.

10. What kind of plant does each seed produce? *Ans.*—The same kind of plant which produces the seed. Gen. 1 :12.

11. What was God's purpose in creating the different classes of plants? *Ans.*—

(1) To serve as food for the lower animals. Gen. 1:30.

(2) To serve as food for man. Gen. 1:29.

(3) To adorn the earth. Gen. 2:9.

12. Name some of the plants which furnish man with food. Name some which furnish food for the lower animals.

13. Name some plants which serve only for adornment.

References.—"Principles of True Science:" Plants in the Beginning, "Spiritual Gifts," vol. 3, p. 33; "Patriarchs and Prophets," pp. 44, 90. "Parts of His Ways," section 6, chapter 1.

Suggestions to Teachers.—We now take up the study of inert matter, but possessed of the principle of life,—plants. The dry land is now robed with living green. The power of God has taken the dust of the ground and transformed it into forms of beauty. The study of plants should be taken up in the early spring-time. As the plants awaken from the winter's sleep, the students should observe the gradual unfolding of the buds, leaves, flowers, and fruit. The first thing we shall study will be a few of the typical seeds. At this time the teacher should plant in the sand or sawdust some beans, Indian corn, squash and castor-oil seeds.

LESSON II.

"Consider the Lilies."

1. Does the Lord want us to study the plants He has created? Matt. 6:28.

2. What are we to consider as we study plants? *Ans.*—How they grow. *Id.*

3. Why should we study how plants grow? *Ans.*—Because their growth illustrates Christian growth.

4. Does the Lord expect us to grow spiritually? 2 Peter 3:18.

5. How does He say Israel is to grow? *Ans.*—"As the lily." Hosea 14:5. Who are Israelites? *Ans.*—Those who prevail with God. Gen. 32:28.

6. What does the lily and all other plants need in order to grow? *Ans.*—(1) Light. (2) Heat. (3) Air. (4) Water. (5) Soil.

7. Do the plants worry and fret as to how they will obtain light, heat, air, etc.? Matt. 6:28.

8. How then do they get them? *Ans.*—The Lord gives, and the plants simply receive, and thus they grow.

9. How does the beauty of the lily compare with earthly pomp and splendor? Matt. 6:29.

10. What lesson does the Lord want us to learn from the plants of the field? *Ans.*—The lesson of simple faith and trust in God. Matt. 6:29, 30.

11. What must we receive in simple faith if we would grow spiritually? *Ans.*—

(1) The light of righteousness.
(2) The heat of zeal and earnestness.
(3) The breath of life—Spirit of God.
(4) The water of life—Gospel of Christ.

12. Where are all these spiritual blessings to be received? *Ans.*—Into the soil of the heart.

13. What is to grow in the soil of the heart? *Ans.*—Seed,—the Word of God.

14. When Christians will receive the blessing of the Gospel as the plant receives the things necessary for its growth, what will be the result? Ps. 92:12, 13.

References.—"Principles of True Science:" Lily, Consider the, "Christian Education," pp. 172, 173; Lily and Christian Growth, "Mount of Blessing," pp. 136, 138. "Parts of His Ways," section 6, chapter 2.

Suggestions to Teachers.—The most important part of plant study is plant growth. Plants depend upon God for what they need. So Christians should depend upon God for all their blessings, both spiritual and temporal. Many times God in His Word illustrates the growth of the Christian by the growth of plants. Read Ps. 1:1-3; Jer. 17:7, 8. We shall study the plant in the order of its growth and development,—seed, root, stem, bud, leaf, flower, and fruit. Read Sp. T. Ed., pp.

11

68, 69. The next lesson will take up the study of seeds as related to light, heat, air, water, and soil. You should read the suggestions of the next lesson now, so that you may have everything in readiness when you come to it. Soak a cupful of beans, peas, corn, and squash seeds for the next lesson.

LESSON III.

The Relation of Seeds to Light and Heat.

1. Is light necessary to the growth of seeds? Experiment No. 1: Place blotting-paper at the bottom of a tumbler and a cup. Moisten the paper, and put upon it several seeds (peas, barley, corn, and wheat) which have been soaked twenty-four hours. Place the tumbler in a light place; cover to prevent evaporation. Cover the cup so that no light will be admitted. Add water occasionally to keep the blotting paper moist. The cup and tumbler should be placed side by side so they will have the same temperature. Watch for results, and indicate them in the following table:—

No. seeds sprouted in	24 hrs.	48 hrs.	72 hrs.	96 hrs.
In cup	———	———	———	———
In tumbler	———	———	———	———

N. B. Take special pains to have the heat and moisture of the cup and tumbler the same.

2. Is heat necessary to the growth of seeds? Experiment No. 2: Arrange several vessels as in Experiment 1. Put into each vessel the same number of soaked seeds (corn, peas, beans, or squash), and put them in places where they will be exposed to different, but constant, temperatures. These temperatures should be carefully made by a thermometer. The following temperatures are merely suggested; others may be found more convenient. Note the rate of germination in each place, and record it in the following table:—

No. seeds sprouted in	24 hrs.	48 hrs.	72 hrs.	96 hrs.
At 32 degrees	———	———	———	———
At 50 "	———	———	———	———
At 70 "	———	———	———	———
At 90 "	———	———	———	———

3. What familiar illustration can you give showing that light and heat are necessary for plant growth? *Ans.*—Plants growing in the cellar look pale and sickly. Plants are destroyed by cold during the winter.

4. Compare the vegetation of the North Frigid, North Temperate, and Torrid Zones.

5. Physical light is necessary to temporal life in this world. What is necessary for eternal life? John 1:4-9; 8:12; 10:10.

References.—"Principles of True Science:" Seed Growth and Spiritual Growth, "Christ's Object Lessons," p. 64; Seed, the Creation of, "Christ's Object Lessons," p. 80; Seed Germination Aided by Electricity, "Christ's Object Lessons," p. 63. "Parts of His Ways," section 6, chapter 3. Botany, see Seedlings and Seed Germination.

Suggestions to Teachers.—This lesson is made up largely of experimental work. Each pupil should perform these two experiments and hand in the table of results to the teacher. Soak for 24 hours a cupful of different kinds of seeds for the experiments in the next lesson. These experiments, to work out successfully, must be carefully done. Place some of the best tables upon the blackboard so that all the class may see them and copy them into their note-books. Each pupil should have a good note-book in which to make notes and drawings as he studies plant and animal life.

LESSON IV.

The Relation of Seeds to Air and Water.

1. Is air necessary to the growth of seeds? Experiment No. 3: Place some seeds in a bottle partly filled with water; then remove the air from the bottle by means of an air-pump. If you are not provided with an air-pump, the experiment may be performed as follows: Most seeds will not grow

under water, but the sunflower seed will. Boil some water, and place it in a bottle as above, only the bottle should be entirely filled with the water. Remove the shells from a number of sunflower seeds, and drop these into the bottle. Now put a rubber cork into the bottle, thus allowing no air to enter. Take another bottle, and fill it half full of ordinary water. Place in this some shelled sunflower seeds. Leave the bottle uncorked. Place both bottles where they will have the same temperature, and watch for results.

2. Why was the water in one bottle boiled, while in the other it was not?

3. What effect does the germination of seeds have upon the surrounding air? Experiment No. 4: When experiment 3 has been finished, insert in the air above the seeds in the second bottle a lighted pine splinter, and notice what happens to the flame. What produces this result?

4. Is water necessary to the growth of seeds? Experiment No. 5: Arrange seeds in four vessels, as follows: In the first put blotting-paper that is barely moistened; on this put some dry seeds. In the second put some blotting-paper that is barely moistened, but on this put seeds which have been soaked for twenty-four hours. In the third vessel put water enough to thoroughly soak the blotting-paper, and use soaked seeds. In the fourth pour water enough to half cover the seeds. Place these four vessels where they will have the same temperature and light, and make a table showing the time required for the germination of the seeds in each vessel.

5. What practical examples can you give showing that water really is necessary for the growth and development of plants?

6. Why is vegetation so scarce in the Sahara Desert and the Desert of the Great Plains in the western United States?

By these experiments we have found that seeds, in order to grow, must have light, heat, air, and water. What must Christians, who are of the "seed of Abraham," have in order to

grow? Ans.—1. The light of life. 2. Heat—Christian zeal. 3. The breath of life—the Spirit of God. 4. The water of life—the gospel of Christ.

References.—"Principles of True Science:" Seed Germination Represents the Resurrection, "Christ's Object Lessons, p. 87; Seed Germination Represents Christ's Sacrifice, "Christ's Object Lessons," p. 86. "Parts of His Ways," section 6, chapter 4. Botany, see Seedlings and Seed Germination.

Suggestions to Teachers.—This lesson completes the study of seed germination and should be worked out carefully by the student and teacher. These principles of seed growth once understood by the pupils, will aid them much in the study of all phases of plant development. The next four lessons will be upon the study of seeds as to their structure and development in the process of growth. We shall study four typical seeds—bean, castor-oil bean, Indian corn, and squash seeds. The pupils should do this work at a table, where the necessary seeds will be supplied.

LESSON V.

The Common Bean.

1. Compare a number of white beans, and see if they are all alike in shape and surface markings.

2. What other colors sometimes have beans? Collect as many different colored beans as you can find, and see if they have the same shape and surface markings.

3. What are the names of the different markings found on the surface of beans? *Ans.*—

(1) The scar where the seed is attached to the pod is called the *hilum.*

(2) Near the hilum is a minute opening called the *micropyle,* more easily seen in the pea. In the bean it may be seen plainly under a lens. This small opening was made by one of the little pollen roots when it entered the seed in the fertilizing process.

(3) On the opposite side of the hilum from the micropyle is a little protuberance, which is called the *chalaza*. This is the place where the seed-coats blend with each other, and where the nutriment enters the growing seed.

4. Draw one of the beans, showing the three surface markings just described.

5. With a sharp penknife remove the outer skin, called the *testa*, from a bean which has been soaked in water twenty-four hours.

6. What do you observe on removing the testa from the bean? *Ans.*—

(1) The bean separates into two halves, which are the first leaves of the bean. They are called *cotyledons*. These cotyledons furnish food for the young plant when it first begins to grow. After the plant appears aboveground, the cotyledons shrink up and drop off the stem.

(2) On one of the halves you will notice, located near the hilum, a small pointed body, called the *caulicle*. This is the stem of the little plant. The pointed end of the stem produces the root, which goes down into the ground.

(3) On the opposite end you will notice two small, delicate leaves, called the *plumule*. These are the first permanent leaves of the bean. Between these is a small bud, which develops into the second pair of leaves.

7. Make drawings showing the cotyledon with the caulicle and plumule. With the aid of a magnifying glass make a large drawing of the leaves of the plumule, showing the little veins.

8. Place some soaked beans on moist blotting-paper under a glass cover. Notice the changes which take place in the stem and leaves of the little plant as it develops. Draw.

9. Make drawings representing three stages of the growth of the bean after it appears aboveground.

10. Study the common pea, comparing its structure with that of the bean. In what respects are they alike, and in what respects do they differ?

11. Write a short story which will contain an account of your observations in the study of the bean and the pea.

References.—"Parts of His Ways," section 6, chapter 4. Botany, see Bean and Pea.

Suggestions to Teachers.—In the two previous lessons you have taken up the study of seeds in their relation to light, heat, air, and water. In this lesson you will take up the study of the common bean and pea, first noticing the external and internal structure before they are acted upon by the vital agencies of life. In the second place, you will study them to observe the transformations which take place in the process of growth. The student should enter heartily into these studies of seeds, and should take part in preparing the soil and planting the seed. You should put to soak some corn seed, so that it may be ready for the lesson to-morrow. Each pupil should be provided with a small microscope, a hard lead-pencil, and an eraser.

LESSON VI.

The Castor-Oil Bean.

1. Does the castor-oil bean look like the common white bean? What is its general shape and color?

2. What are the surface markings upon the castor-oil bean? *Ans.*—

(1) At one end of the bean is a large, conspicuous protuberance called the *caruncle.*

(2) The *hilum* may be faintly seen at the edge of the caruncle, on the flat side of the bean.

(3) Extending from the hilum to the other end of the bean may be seen a string-like marking called the *raphe*.

(4) The *chalaza* is situated at the end of the raphe opposite the hilum.

3. Draw the entire bean, indicating the surface markings mentioned above.

4. Remove the testa from the castor-oil bean. How does it compare with the testa of the common bean? Observe the delicate inner seed-coat, called the *endo-pleura*. Within this is the kernel of the bean.

5. Split the kernel vertically, so as to expose the inner surfaces of the *cotyledons*. Examine the surface of a cotyledon with the microscope.

6. What is the structure of the castor-oil bean on the surface of each cotyledon? *Ans.*—The surface of each cotyledon represents a single leaf, having netted veins.

7. Draw the inner surface of one of the cotyledons so as to show:—

(1) The outline and veins of the cotyledon.

(2) The short, straight caulicle, or stem.

(3) The surrounding tissue, called the endosperm, which contains the food material for the early growth of the plant.

8. Plant some castor-oil seed, and make drawings representing three stages of its growth aboveground.

9. Compare the appearance of the castor-oil bean plant with that of the bean. How do the pods containing the seed compare? What is the shape and veining of the leaves?

10. Which is the most useful to man, the common bean plant or the castor-oil plant?

11. Write a short account of what you have learned in studying the structure and the germination of the castor-oil bean.

References.—"Parts of His Ways," section 6, chapter 4. Botany, see Castor-oil Bean.

Suggestions to Teachers.—The castor-oil bean resembles the common bean in that it contains two cotyledons, which furnish food for the early growth of the plant. It contains, however, much larger leaves in the plumule than the bean. Its caulicle is short and straight, instead of being curved, as in the common bean. Its outer structure reminds one more of a bug than of a seed. In your study of the seeds of different plants, you can bring into the recitation the question of their economic value. Peas and beans are of great value as food, while the castor-oil seed is valuable for the oil which it contains and also for medicinal purposes. If you have time, the matter of the proper cultivation of the seeds can be brought out.

LESSON VII.

Indian Corn Seed.

1. Study closely the external features of a kernel of corn. How do the two sides differ? How does the corn seed differ from the bean and the pea externally?

2. Make a drawing of a kernel, showing the groove upon one side.

3. With a sharp knife make a vertical section perpendicular to the flat sides of the kernel. Repeat the process, if necessary, until a good specimen is secured. Use a soaked kernel if you fail with a dry one.

4. What do you observe on examining the cut surface of the grain? *Ans.*—

(1) The strong external covering, composed of the united coats of the fruit and the seed.

(2) The *endosperm,* consisting of starch and other food materials, very hard in the dry grain, but easily cut after it has been soaked for some time in water; a part of the endosperm is white and mealy, but other portions are yellow and very hard.

(3) Next to the endosperm, and surrounded by it, is a compact, spongy substance called the *scutellum.*

(4) Inside the scutellum is the little plant, consisting of the root, which points toward the small end of the grain. The end of the root is covered with what is called *the root sheath.* The scutellum also contains the conical *plumule,* which points toward the large end of the grain. The work of the scutellum is to provide the little plant within it with food. It obtains this food from the endosperm.

5. How many leaves are there in the plumule of the corn seed? How many in the bean? In the pea?

6. With a sharp knife make a vertical section, perpendicular to the one made above. Locate in this section the endosperm, scutellum, plumule, and root.

7. Make a cross section of a kernel at different points, and locate the parts mentioned in No. 6.

8. Make drawings showing transverse and vertical sections of a kernel of corn. These drawings should show the relative positions of all the parts which you have observed.

9. Plant several kernels of corn, and make drawings showing the three stages of growth.

10. In what respect does the corn seedling, when it first comes through the ground, differ from the bean and pea? How do the young leaves in their veining differ from that of the bean and pea?

11. What becomes of the large kernel of corn after it has sprouted? What is illustrated by the death and decay of the seed, which is brought about by giving up its life to the new plant? *Ans.*—The principles of the new birth. Matt. 13:1-32; 1 Peter 1:23; Gal. 3:16, 29.

References.—"Parts of His Ways," section 6, chapter 4. Botany, see Indian Corn Seed.

Suggestions to Teachers.—In this lesson the economic value of corn as a food for both man and the lower animals may be considered. It would be well to study along with the corn some wheat, oat, and rye seeds. When these seeds sprout, they send up a single leaf, which is parallel-veined, like the corn. Do not fail, at the proper time, to bring out spiritual lessons in your study of seeds. The spirit of self-sacrifice is shown by the seed in giving itself up as food for the new plant. Christ is called the "Seed of David." Christians belong to the "seed of Abraham." The Word of God is seed which is to be planted in the heart. Soak some squash seeds for the next lesson.

LESSON VIII.

The Squash Seed.

1. What are the shape and color of the squash seed? In what respects does it resemble and in what respects differ from the seeds already studied?

2. What are its surface markings? Locate the hilum, where the seed was attached to its place of growth.

3. Make a drawing of the squash seed showing the hilum.

4. Take a soaked seed and chip away the white outer shell, the testa, and observe the thin inner skin, called the *tegmen,* with which the kernel of the seed is closely covered. What is the color of the tegmen?

5. Strip off the tegmen, and separate the kernel into its two cotyledons. At what point are the cotyledons fastened together?

6. Where is the caulicle in the squash seed? *Ans.*—It is the sharp-pointed end of the kernel.

7. Make a drawing showing the two cotyledons connected with the caulicle.

8. With a sharp knife make a cross-section of the squash seed. Observe in this section the testa, tegmen, and the two cotyledons.

9. Make a drawing showing the parts indicated in No. 8.

10. With a sharp knife cut across near the middle of a seed which has been soaked in water twenty-four hours. Squeeze the kernel from the half of the seed which has the pointed end. Strip off the tegmen, and examine with a magnifying glass the uncovered kernel.

11. Make a drawing showing the caulicle and the veins of the uncovered kernel.

12. Plant some soaked squash seed in sand. Which end of the seed develops the root? Which end should be placed in the ground when the seeds are planted?

13. Compare the cotyledons of the squash with those of the bean. Do they furnish food for the little plant? Do the cotyledons shrink up and drop off, or do they become permanent leaves?

14. Make drawings indicating four stages in the growth of the seedling. These drawings should be made about two days apart. Observe how the sand is pushed aside by the ascent of the young seedling, and make one drawing to show which part appears first above the ground.

15. Do the leaves of the squash resemble the leaves of the corn or of the bean? Compare the stems of the bean, corn, and squash.

References.—"Parts of His Ways," section 6, chapter 4. Botany, see Squash, Pumpkin, Watermelon, and Cucumber Seed.

Suggestions to Teachers.—In the four studies on seeds, the pupils have become acquainted with the little plant-embryo contained in each seed. They have also learned how the embryo develops into the more mature plant. One part of the embryo, the caulicle, sends a root downward into the ground; this part seems to start first in the process of germination. The caulicle also grows upward, producing the plumule, which contains the first permanent leaves of the plant. The proper order of study is the order of development; therefore the next lessons will be upon roots. If the student has been observing, he has already seen that the different seeds produce different kinds of roots. It would be a good plan to conclude the study of seeds by considering the parables of Christ with reference to the seed and the sower. There are many simple lessons in these parables which will be of spiritual

benefit to the pupils. During the spring-time, when the gardens are planted, it would be well for each student to have a little plot of ground which he could cultivate. He could place in this different kinds of seeds, and watch their growth and development. This would occupy his mind for many hours, and would keep him out of mischief.

LESSON IX.

Roots and Their Uses.

1. Review the last four lessons, so that you can give the names of all the parts of the seeds which you have studied.

2. What name is given to that part of the plant which is below the ground? *Ans.*—The root. Above the ground? *Ans.*—The stem.

3. What develops from the stem? *Ans.*—Buds, leaves, flowers, fruit, and seed.

4. Examine the roots of the seedlings which you have already studied. Do they all look alike?

5. What are the functions of the roots? *Ans.*—

(1) They fasten the plant firmly to the ground.

(2) They store up nourishment, which serves as food for both man and the lower animals. Examples: The beets, carrots, turnips, parsnips, etc.

(3) The roots of some plants penetrate the trunks and branches of trees, and obtain their nourishment from them, instead of from the soil.

(4) Many vines cling to the walls of buildings by means of aerial rootlets. Example, the ivy.

(5) The principal function of the roots is to gather nourishment from the soil, and to transform it into vegetable tissue. The root may properly be called the stomach of the plant.

6. Do you think that the Lord, when He created plants, designed that they should gather their nourishment from the ground? Give Bible proof. Gen 2:9.

7. There are three classes of plants: (1) Those obtaining their nourishment from the soil; (2) those obtaining their nourishment from other plants; (3) those obtaining their nourishment from decaying vegetation. These three classes of plants represent three classes of people. Who are they, and to which class do you belong?

8. What passage of Scripture affirms that we are to be rooted and grounded in the truth, even as the plant is rooted and grounded in the earth?

References.—"Principles of True Science:" See Root. "Parts of His Ways," section 6, chapter 5. Botany, see Roots.

Suggestions to Teachers.—While the spring-time is the most favorable for the study of plants, it is equally favorable for the study of animals. The study of plant and animal life should be carried on simultaneously. The lessons on seeds may be studied before the buds and leaves begin to appear, but just as soon as animal life begins to manifest itself, the pupil should be set to work along that line of study and observation. Probably the first phase of animal life that will be brought to their attention will be the returning of the birds in early spring-time. You should take up the subjects Water Animals, chapter 8, and Air Animals, chapter 9, so that you will be prepared to study the water animals and birds as soon as they appear. Should this be done, you will study plants three days in the week, water animals one day, and birds one day. A little later in the season, when the insects begin to appear, you should take up the study of the Land Animals, chapter 10. Still use three days for the study of plants and the two remaining days for the study of the different phases of animal life as it manifests itself from day to day.

LESSON X.

The Different Kinds of Roots.

1. Study the roots of various plants, and note the following kinds:—

(1) Primary roots. The stem develops one large main root, sometimes called the tap-root.

These are divided into two classes: (*a*) Non-fleshy, those which are hard and tough, consisting largely of woody fiber. Examples: The primary root of the oak, hickory, etc. (*b*) Fleshy, those which are soft and juicy. They are divided into three kinds: (1) Conical roots. These are shaped like an inverted cone. Examples: The parsnip and carrot. (2) Napiform, or turnip-shaped, roots. These roots are largest near the top, but taper off very abruptly. Examples: The beet and turnip. (3) Fusiform, or spindle-shaped, roots. These roots are largest in the middle, but taper gradually toward both ends. Example, the radish.

(2) Secondary roots. The branches of primary roots are secondary roots.

(3) Fibrous roots. Instead of the stem producing one large primary root, it sends out many small thread-like roots. Examples: Corn, grasses, etc.

(4) Adventitious roots, the roots which form so readily on the stem in unusual places. These are easily produced on cuttings of the willow, geranium, and many other plants, when placed in damp earth or water.

(5) Aerial roots. These roots are formed in the air. They absorb moisture and other useful substances from the air. Examples: The ivy and tropical air plants.

(6) Parasitic roots. These roots penetrate the stems of plants and draw their nourishment from them. Examples: The dodder and mistletoe.

2. Make drawings of the roots of corn, oak, beet, carrot, turnip, and radish.

3. How are roots classified as regards duration? *Ans.*—

   (1) As annuals. Roots continuing one year, as corn, wheat, oats, etc.

   (2) As biennials. Roots continuing two years, as the beet, turnip, radish, etc.

   (3) As perennials. Roots continuing many years, as the oak, ash, maple, etc.

4. Review the subject of roots, giving their kinds, functions, and duration.

5. Make drawings of the different kinds of roots mentioned in this lesson.

References.—The same as in lesson 9.

Suggestions to Teachers.—The students should, as far as possible, make drawings of all the different kinds of roots. These sketches should be made from the roots and not from pictures. Roots may be obtained in early spring by digging in the soil. All the studies on plants should be made with the specimens in hand, rather than from books. After studying the root, that part of the plant which fixes it to the soil and provides it with nourishment, you would naturally take up the study of stems, but if spring is about to open, pass on to the study of the first two lessons in chapter 8, and then to the first two in chapter 9. After this return to the study of plants, but spend two days each week thereafter in the study of the different phases of animal life, as it develops.

LESSON XI.

Stems and Their Growth.

1. In observing the growth of seedlings, you found that one part of the plant grew upward. What is it called?

2. What is the shape of the corn, pea, and bean stems?

3. Observe the stems of several plants, and notice whether they are round, square, triangular, rough, smooth, hairy, or prickly, etc. Make a collection of as many of the above kinds of stems as you can find.

4. What is the stem of a tree called? *Ans.*—The trunk.

5. What is the outer covering of the tree called? *Ans.*—The bark. How does the bark of trees differ? Can you distinguish trees by their bark?

6. Saw off a block from an oak, maple, or ash log, and observe the structure of the end.

7. What do the rings denote? *Ans.*—The growth each year. How old is the tree from which this block is taken? Which ring represents last year's growth, the outer or the inner ring?

8. Stems having these circular growths are called *exogenous,* which means growing on the *outside.*

9. Make a drawing representing the end of the block just sawed.

10. Make a cross-section of a full-grown cornstalk. How does it differ from the block studied above? *Ans.*—The inner portion of the stem is pithy, and the woody fiber is not arranged in circles, but scattered throughout the pith.

11. Cut through the bark of a cornstalk and then pull the stem apart. What do you discover?—Stems of this character are *endogenous,* which means growing on the *inside.*

12. What is the purpose of stems? *Ans.*—To form a connection between the roots and leaves. They conduct the sap up into the buds, leaves, flowers, and fruit.

13. What is grafting? What does the apostle Paul illustrate by referring to the grafting process? Romans 11.

References.—"Parts of His Ways," section 6, chapter 6. Botany, see Stems.

Suggestions to Teachers.—The lessons on stems should be made very practical, teachers and students gathering as many kinds as possible. Have the pupils do considerable work in drawing stems, for nothing will impress these lessons on the mind so much as this kind of work. The cornstalk represents one great class of stems, the endogenous stems, while most trees represent another class, the exogenous stems. Plants having but one leaf when they first come through the soil are endogenous, while those having two or more are exogenous. Have the pupils classify the stems of the castor-oil bean, the pea, squash, Indian corn, and common bean.

12

LESSON XII.

The Different Kinds of Stems.

1. What are the two great classes of stems? *Ans.*—(1) Exogenous. (2) Endogenous.

2. How do they differ in their manner of growth? Give examples of each.

3. What are some of the different forms of stems?

4. How are the stems classified as regards their texture? *Ans.*—

(1) Those which have but little or no woody fiber, and which die down to the ground each year. Examples: The grasses, milkweed, peas, beans, etc.

(2) Those which have woody fiber, and which survive from year to year. Examples: The shrubs and trees.

5. What directions do different stems take as they grow? *Ans.*—

(1) Some are erect, growing upward.

(2) Some are diffused, spreading loosely in all directions.

(3) Some are declined, bending to one side.

(4) Some are ascending, rising obliquely.

(5) Some are prostrate, lying on the ground.

(6) Some are climbing, ascending by clinging to objects for support. Examples: The ivy, grapevine, pea, etc.

(7) Some are creeping, crawling along on the ground or just beneath it, and striking root several times, as in the white clover.

(8) Some are twining, coiling around stems or other supports. Examples: The hop and morning-glory.

6. Give examples of all the different stems mentioned above.

7. Make drawings representing these different stems.

8. Do these stems represent different classes of people? What classes, and in what way? Which class of stems represents you in the getting of your lessons?

9. What stems represent the relation we should sustain to Christ? *Ans.*—Those which cling to some support.

10. Notice that the main stem of many trees runs to the very top, while in others it is lost by dividing into large branches. Give examples of these two kinds of stems.

References.—The same as in lesson 11.

Suggestions to Teachers.—Have the pupils plant some seed which will grow some of the stems mentioned in this lesson. Take them into the woods and show them all the various kinds of stems which you can find. In the variety of stems which make the woods so beautiful the wisdom of the Creator is again manifested. So far we have studied only the stems aboveground. The next lesson will treat of the stems underground.

LESSON XIII.

Underground Stems.

1. Name the two great classes of stems.

2. How are stems divided as to texture?

3. Give the names of stems classified as to their direction of growth.

4. The stems studied so far grow aboveground. A great many grow underground. How can you tell the difference between a stem and a root? *Ans.*—A stem is jointed, and produces buds and leaves, while roots do not.

5. Name some of the principal underground stems.

(1) Rootstocks. This underground stem grows horizontally under the surface, and is covered with scales, which are reduced forms of leaves. Examples: The mints, sedges, and Solomon's seal.

(2) Tubers. This is a thickened rootstock, having buds (eyes) on the sides. Potatoes are produced by the depositing of starch at the ends of these underground stems. The stems are stouter and more cylindrical than the roots.

(3) Bulbs. These are very short, stout underground stems, either coated, as in the hyacinth, or scaly, as in the onion. These scales, or closely-crowded layers, represent leaves.

6. Carefully remove the dirt from a hill of potatoes and notice the roots and the underground stems which bear the potatoes.

7. Make a vertical section through an onion. Where are the roots of the onion? To what class do they belong?

8. Make drawings of a rootstock (Solomon's seal); of a tuber (potato); of a bulb (onion).

9. What purpose do the underground stems serve? *Ans.*—

(1) They send up new shoots, which develop into plants.

(2) They store up nourishment, which causes very rapid growth of the plant in the spring. Nearly all of the early-flowering herbs in the temperate climates, like the crocus, snowdrop, spring-beauty, tulip, and skunk-cabbage, blossom early, on account of their richly-stored underground stems, or rich, fleshy roots.

(3) They serve as food for man and the lower animals.

References.—"Parts of His Ways," section 6, chapter 7. Botany, see Underground Stems.

Suggestions to Teachers.—The teacher should go out with the pupils and dig up as many underground stems as they can find. In the spring these underground stems will be very interesting to study, for they will be sending forth their new shoots. Of course the potato, onion, and lily can be studied without difficulty, as they can be easily secured. The next lessons will treat of some very common stems, mentioning them by their familiar names.

LESSON XIV.

The Common Names of Stems.

1. Give the names and the examples of underground stems.
2. What purposes do they serve?
3. What is the difference between an underground stem and a root?
4. What are some of the common names applied to stems?
   - (1) Culm. This term is applied to all straw stems.
   - (2) Caudex. A name applied to the palm.
   - (3) Suckers. These are the underground stems of the currant and gooseberry. They send up new shoots at the nodes of the stems, which develop new plants. Gardeners take advantage of this peculiar method of propagation and multiply their plants by cutting the underground stem between the new shoots, thus making each shoot a separate plant.
   - (4) Stolons. These are offshoots of the plant, the tips of which, if buried in the soil, produce new plants. The rose and raspberry produce stolons.
   - (5) Runners. These are long running stems which take root every few inches. The strawberry is a familiar example. By cutting the plants between the nodes, new plants are produced.

(6) Tendrils. The ends of the stems or branches of some plants form into a spiral coil for the purpose of climbing. Peas and vines of various sorts produce tendrils. Many plants in the dense forests would never see the sun were it not for this special device which they have for lifting themselves above their neighbors.

(7) Thorns. In many plants the branches (which are divisions of the stem) become stunted and develop into thorns.

5. Make drawings representing plants with suckers, stolons, runners, tendrils, and thorns.

6. Of what are thorns a result? Prove your answer from the Bible. P. T. S., see "Thorns" and "Briers."

References.—The same as in lessons 11 and 12.

Suggestions to Teachers.—This lesson should be made very practical by digging in the ground and finding the suckers of the currant and gooseberry. An experiment should be performed so that the pupils may see how the stolons will develop new plants when their tips are covered with soil. Study in the garden the strawberry and pea so that the pupils may recognize the runners and tendrils. Examine the thorns of the thorn-apple and of the locust tree. Let nature be your text-book.

LESSON XV.

Branches and Their Arrangement.

1. Review the lessons on stems.

2. Into what do the stems of plants divide? *Ans.*—Into branches.

3. How are the branches arranged on the main stem? *Ans.*—

(1) Into regular branches.

(*a*) Alternate branches. Branches arranged alternately will be found to form a more or less

spiral line about the stem. The oak tree affords a good example. In some trees the spiral is made more rapidly around the stem than in others. In the apple, pear, cherry, poplar, and oak, one passes over five spaces before coming to a branch which is over the first one, and in doing this two complete turns are made about the stem.

(*b*) Into opposite branches. These branches are arranged on exactly opposite sides of the stem. The maple is a good example of branches arranged oppositely.

(*c*) Into whorled branches. When more than two branches come from the same node of the stem, forming a circle about it.

(2) Into irregular branches. When there is no order in their arrangement on the stem.

4. What plants have most frequently the alternate arrangement of branches? *Ans.*—Trees and shrubs. What plants have the opposite arrangement? *Ans.*—The herbs.

5. Why do trees and shrubs have alternate branches? *Ans.*—The Creator so arranged them that they might present as much leaf surface as possible to the sunlight.

6. Make drawings which will illustrate the modes of branching mentioned above.

7. What beautiful lesson did Christ teach by referring to the relation existing between the stem and its branches? John 15: 1-6.

8. What develops the branches? *Ans.*—The stem, by means of its buds.

References.—"Principles of True Science:" See Branches. "Parts of His Ways," section 6, chapter 8. Botany, see Branch Arrangement.

Suggestions to Teachers.—This closes the lessons on Stems, and the subject naturally following is that of Buds. Again the teacher is reminded that plants and animals should be studied at the same time. While the pupils are out making collections and observations

with reference to plants, they will see frogs, insects, snakes, birds, etc., and they should make careful observations and collections. If you have not already begun to make a list of the returning birds, you should do so at once. Turn to chapters 8 and 9, and have at least two lessons per week, one on Water Animals and one on Air Animals. As soon as the bugs and beetles appear, take up one lesson per week in chapter 10, Land Animals, but continue the lessons on plants three days per week.

LESSON XVI.

Buds and Their Uses.

1. Review roots and stems, giving the kinds and uses of each.

2. Examine carefully the stems and branches of some trees and shrubs. What do you find on them? *Ans.*—Buds.

3. What is a bud? *Ans.*—It is an offshoot from a stem or branch.

4. Into what do buds develop? *Ans.*—Into branches, leaves, and flowers.

5. Collect twigs from the apple, cherry, maple, lilac, horse-chestnut, elm, etc., and notice the structure of the buds.

6. Notice the scars just below the buds. What caused them? *Ans.*—The falling of last year's leaves.

7. Did any of the seedlings studied develop buds? *Ans.*—The squash and the bean developed buds between the plumule leaves. What developed from these buds?

8. What enabled the delicate buds to live through the winter? Examine carefully the buds of the horse-chestnut, poplar, willow, and cottonwood, and decide if the question is a hard one to answer.

9. How are the scales arranged? Why?

10. With what are the scales covered? Why? *Ans.*—To keep out the moisture, which would freeze and kill the buds.

11. What do you find just underneath the scales? What is the use of this soft, woolly covering?

12. What causes the scales to break in the spring-time? *Ans.*—The bud within grows and bursts the scaly covering.

13. Whose power gives life to the bud that it may grow? *Ans.*—It is the power of God. Isa. 55:10; Num. 17:5, 8.

14. How far, then, is God from us, since even the buds spring forth by His power?

References.—"Principles of True Science:" See Buds. "Parts of His Ways," section 6, chapter 9. Botany, see Buds.

Suggestions to Teachers.—The pupils should bring in buds from all the familiar trees. As soon as the buds begin to burst, the after-development should be watched very closely. This can be done best by placing some twigs in a dish of water. You should call the attention of your pupils to from four to six familiar trees to watch carefully during the unfolding of the buds into leaves, flowers, and fruit. I would suggest the cottonwood, box-elder, poplar, lilac, maple, ash, elm, and some of the fruit trees, as good examples for this study.

LESSON XVII.

The Various Kinds of Buds.

1. How are the buds arranged on the twigs you have studied? *Ans.*—

(1) As terminal buds, those arranged at the end of the branch, or stem.

(2) As axillary buds, those growing in the axil, or between the leaf and the stem.

(3) As extra-axillary buds, more than one bud growing in the axil of the leaf.

(4) As accessory buds, more than one bud being found on the stems. These are divided into:—

(*a*) Collateral buds, those growing side by side.

(*b*) Superposed buds, one bud growing above another.

(5) As latent buds, those which grow out of the stem when it is cut or injured. When a limb

is cut from a willow, many shoots appear from buds that were latent, hidden underneath the surface of the stem. Cut down a tree, and many sprouts will shoot out from the trunk.

2. Notice that the buds are arranged on the twigs, as the twigs and branches are arranged on the main trunk or stem.

3. How are the buds classified as to their structure? *Ans.*—

(1) As scaly buds, those which are provided with scales to protect them from the cold.

(2) As naked buds, those which have no scales. In tropical regions the buds are not covered. Why?

(3) As leaf buds, those which develop leaves only.

(4) As flower buds, those which develop flowers only.

(5) As mixed buds, those which produce both flowers and leaves.

4. What do flower buds finally produce? *Ans.*—Fruit. What is the difference in the appearance of a flower and leaf bud?

5. Collect the different kinds of buds mentioned above, and mount and classify them on cardboard.

6. Make drawings of the buds mentioned in No. 1.

References.—The same as in lesson 16.

Suggestions to Teachers.—The pupil should make a collection of all the different kinds of buds after he has learned to discriminate between them. These should be mounted on cardboard and properly classified. Do not study buds until you can collect them for class study. The thought of the power and wisdom of God will be impressed upon the mind as the students study, if the Spirit of the Lord is in the school. The Spirit of God is the agency whereby all these things were create' therefore it can reveal these deep things to the mind.

LESSON XVIII.

Leaves.

1. Review the lessons on buds.

2. Into what have the buds developed which you placed in water? *Ans.*—Into leaves.

3. Should you remove from the water the twigs now bearing leaves, what would happen? What does this show as to the relation of water to plant development?

4. What is a leaf? *Ans.*—It is a portion of the stem, or branch, which has widened out so that it is very thin.

5. Compare the leaves of the maple and the pine. How do they compare as to duration? Do the pines and spruces ever shed their leaves? When? When do the oak and maple shed their leaves?

6. What marks the places where last year's leaves were borne? How are this year's leaves situated with reference to the leaves of last year?

7. How are the leaves arranged on the branches? *Ans.*—The same as the branches and buds,—alternately, oppositely, and whorled.

(1) The oak has alternate leaves.

(2) The maple and box-elder have opposite leaves.

(3) Gallium, or goose-grass, has whorled leaves.

8. What is the arrangement of the leaves on the ash, elm, hickory, cottonwood, apple, cherry, and plum trees?

9. Make drawings representing the arrangement of the leaves of the maple, oak, and goose-grass.

10. What are the parts of a leaf called? Take a fresh geranium leaf attached to the branch, and note:—

(1) The long, slender stalk, or petiole.

(2) The thin, expanded portion of the leaf, the blade.

(3) The green, leaf-like appendages attached, one on each side, to the petiole, the stipules.

11. Compare the geranium leaf with other leaves. Is the petiole always present? The stipules? The blade?

12. What is the usual color of leaves? Does the presence or absence of light affect the color of leaves? How can you prove it?

13. Draw a leaf, showing the different parts.

14. For what purpose did the Lord make leaves?

References.—"Principles of True Science:" See Leaves. "Parts of His Ways," section 6, chapter 10. Botany, see Parts and Arrangement of Leaves.

Suggestions to Teachers.—The subject of Leaves is one which will be of great interest to the children. No lesson should be conducted without having leaves in the hands for study. The children will soon learn to recognize the trees by their leaves. In the next lesson we will take up the structure of the leaves, and show how the great wisdom of God is manifested in leaf-building.

LESSON XIX.

The Framework of Leaves.

1. When do trees usually shed their leaves? What exceptions are there to this rule?

2. How are leaves arranged on the branches? Give examples.

3. Name the parts of a leaf. Have all leaves these different parts?

4. What supports the wide, thin leaves so that they do not droop? *Ans.*—The veins.

5. Examine an elm leaf (apple, cherry, oak, or willow will do), and note the following:—

(1) The midrib, which is a continuation of the petiole. This extends from the base to the tip.

(2) The veins extending obliquely from the midrib to the edge of the leaf. These veins are arranged like the barbs of a feather, and so are called feather-veined. Count the veins on each side of the midrib.

(3) The small veinlets which form a network between the veins; thus the elm leaf is pinnately netted-veined.

6. Draw the elm leaf, showing the veins in detail.

7. Compare the leaves of the hazel and the apple with those of the elm. Is the venation the same?

8. Examine the lower surface of a geranium leaf and note:—

(1) Seven large, prominent ribs diverging from the end of the petiole like the fingers from the palm of the hand; hence the leaf is palmately-veined. Where and how do these ribs terminate?

(2) The smaller veins and veinlets form a network, so the entire leaf is palmately netted-veined.

(3) Draw the geranium leaf so as to show the venation in detail.

9. Compare the maple leaf with the geranium leaf. Is the venation the same? How many ribs has the maple leaf?

10. Examine a corn leaf, and notice that the veins run from base to tip of leaf without being connected with little veins. Such leaves are called parallel-veined.

11. Compare the leaves of wheat, oats, and grasses with the corn leaf.

12. Make a drawing showing the venation of the corn leaf.

13. Collect and mount leaves showing the different types of venation mentioned above.

References.—"Parts of His Ways," section 6, chapter 11. Botany, see Venation of Leaves.

Suggestions to Teachers.—The pupils should have a large collection of leaves by the time they complete these lessons, therefore they should mount them upon cardboard which can be written upon with pen and ink. All of the writing should be done upon the back side of the cardboard, the name appearing at the top. The description of the leaf should be written in after the leaf structure and forms are well understood. This description should be written upon ordinary scratch paper and handed to the teacher for correction before it is written upon the card. The form of description will be given a little later. The leaves may be pressed before mounting, yet very good results can be obtained by pasting the fresh leaf on the cardboard.

LESSON XX.

The Shapes of Leaves.

1. Describe the different kinds of veins found in leaves, and give examples of each.

2. What purpose do the veins serve?

3. What is the name of the large vein running through the center?

4. What is the midrib? *Ans.*—An extension of the petiole or handle of the leaf.

5. How many kinds of leaves are there? *Ans.*—

(1) Simple leaves, those leaves which have but one midrib. Examples: apple, cherry, elm, etc.

(2) Compound leaves, those in which the petiole divides, each bearing a simple leaflet. Examples: rose leaves, clover, locust, etc.

6. Make a collection of simple and compound leaves, and draw two of each kind.

7. Make a large collection of leaves, and notice that as regards their shape there are the three following divisions:—

(1) Those largest in the middle and tapering alike toward both ends.

(*a*) Rotund leaves, those which are round, or nearly so. Examples: geranium and nasturtium leaves.

(*b*) Oblong leaves, those which would be rectangular were it not for the rounding corners. Example: milkweed leaves.

(*c*) Elliptical leaves, those tapering from the middle both ways. Examples: rose leaves and strawberry leaves.

(2) Those which are largest near the base and taper toward the apex.

(*a*) Ovate leaves, those resembling the egg in form. Examples: apple, peach, plum leaves, etc.

(*b*) Lanceolate leaves, those largest at the base but gradually tapering toward the apex. Example: willow leaves.

(3) Those largest near the apex, and gradually tapering toward the base.

(*a*) Obovate leaves, just the opposite of ovate.

(*b*) Oblanceolate leaves, just the opposite of lanceolate.

8. Make collections and drawings representing the above-shaped leaves.

9. See if you can find bean, heart, and arrow-shaped leaves. If so, make collections and drawings of the same.

10. What lesson can we learn from the great variety in the forms of leaves?

References.—"Parts of His Ways," section 6, chapter 12. Botany, see Leaf Outlines.

Suggestions to Teachers.—The student should make a collection of leaves representing the different varieties of leaves already studied. The collection so far should represent the parts, kinds, veins, and general shape of leaves. If the teacher is thorough in this work, the students will be able to give the names of the plants of the locality by the shapes and veins of the different leaves. There are other names for the base and apex of leaves, which the teacher may obtain from some botany.

LESSON XXI.

The Margin of Leaves.

1. Give the shapes of different leaves mentioned in your last lesson.

2. Why did the Creator make so many different forms of leaves?

3. Notice the margins of several leaves, and observe the following kinds:—

(1) Entire leaves. The leaf has an outline with no indentations.

(2) Serrate leaves. The edge of the leaf has teeth like a saw.

(3) Dentate leaves. The margin of the leaf has teeth, but they point outward instead of forward as in the serrate leaf.

(4) Crenate or wavy leaves. The edge of the leaf has a wavy or scalloped outline.

(5) Cleft leaves. The edge of the leaf has sharp, angular indentations which extend half way to the midrib, as in the maple.

(6) Lobed leaves. The edge of the leaf has rounding instead of angular indentations, as in the oak.

(7) Parted leaves, in which the indentations reach nearly to the midrib.

(8) Divided leaves, in which the indentations extend to the midrib.

(9) Irregular leaves, in which the indentations are of such irregular character that the leaf can not be classified under the above terms.

4. Make collections and drawings of leaves which have margins as above described.

5. Notice the upper and lower surfaces of different leaves, and discover whether they are smooth, hairy, or woolly, etc.; also variation of color.

6. Increase your collection of leaves to fifty, and write on the back of each card a complete description of each leaf, covering the following points:—

(1) Kinds.
(2) Veins.
(3) Shape of entire leaf.
(4) Shape of base.
(5) Shape of apex.
(6) Margin.

References.—"Parts of His Ways," section 6, chapter 13. Botany, see Leaf Margins.

Suggestions to Teachers.—When the collection of leaves is complete, have the students write out the complete description as indicated in No. 6. This should be done first on common note-paper and handed to the teacher for correction. This description with the name should be placed on the back of the mounted card. When all the work is completed, the children can play games with the leaves, guessing their names something in the same way they play the game of Authors. In a few seasons the students will know a great many plants by becoming acquainted with their leaves. Our next lesson will be on the Purpose of Leaves. It is not necessary to finish the mounting and description of leaves before taking up the study of flowers. Some of the nicest leaves develop later in the year. Encourage the pupils to continually enlarge their collection. Each subject should be so developed that the student will feel that he must be a constant observer of nature in all her different phases.

LESSON XXII.

The Purpose of Leaves.

1. What is the usual color of leaves?

2. Name some plants which do not bear green leaves? *Ans.*—Foliage plants.

3. What can you say as to the color of the leaves of foliage plants?

4. Do you think that green is the most beautiful color for leaves? Why? What gives the green color to the leaves? *Ans.*—The sunlight. How can you prove it?

5. For what purpose did God make leaves?

(1) For storage. Study the leaves of the century plant, also the seed leaves of the pea and bean.

(2) For protection. Study the tendrils of peas and vetches.

(3) For holding moisture. Study the leaves of the common pitcher plant.

(4) To give off moisture into the air. Place a fresh leafy branch of any house plant in a glass fruit jar, and put on the cover. Note what has taken place in the course of two hours' time.

(5) For lungs to the plant. The leaves inhale carbon dioxid and exhale oxygen.

(6) To catch food. Study the Venus fly-traps.

(7) For beauty. Gen. 2:9.

6. What parts of the plant have you studied thus far?

7. What have you learned about leaves which will be of benefit to you?

8. Who causes the leaves to grow? Num. 17:1-8.

9. When God's power is taken away from the plant, what happens to the leaves? Matt. 21:18-22.

10. What should a plant bear besides leaves? *Ans.*—Fruit.

11. What does the Lord use in His Word to represent the Christian? Ps. 1:1-4; Jer. 17:5-7. The heathen? Jer. 17:6.

12. What do the leaves of a tree represent? *Ans.*—Profession. The fruit? *Ans.*—Works.

13. What kind of tree would represent you?

References.—"Parts of His Ways," section 6, chapter 14. Botany, see Leaf Functions.

Suggestions to Teachers.—In studying this lesson endeavor to have the specimens spoken of in hand for the recitation. The respiration of the plant, referred to in No. 5, may be demonstrated by col-

lecting the bubbles of gas which rise from pond scum or some slimy plant which lives beneath the water. The bubbles may be collected by placing a funnel over the plant, and then an inverted bottle filled with water over the nose of the funnel, which must be completely covered with water. The bubbles of gas will drive the water from the bottle. This gas, by the lighted splinter test, will be found to be oxygen.

LESSON XXIII.

The Arrangement of Flowers.

1. Name the different parts of the plant as far as we have studied them.

2. What beside leaves develop from buds? *Ans.*—Flowers.

3. How are the flowers arranged on the plants? *Ans.*—

(1) In racemes. Examine the lily-of-the-valley, larkspur, false indigo. The flowers are scattered along on a stem like rachis. The flower handles (pedicels) are nearly equal in length.

(2) In corymbs. Examine the hawthorne, sheep laurel, and trumpet-creeper. The same as the raceme, but the lower pedicels are lengthened, so that the lower flowers are brought up to nearly the level of the uppermost, making a nearly flat-topped cluster.

(3) In umbels. Examine the parsnip and milkweed. The rachis is wanting, and all the pedicels proceed from one point of the stem.

(4) In spikes. Examine the plantain and mullein. Like the raceme, except that the flowers have very short pedicels.

(5) In catkins. Examine the birch, willow, and poplar. It is like the spike, but has small flowers, with scale-like bracts.

(6) In spadixes. Examine the Indian turnip. It has an erect, rigid spike, enclosed in a flower-like leaf called a spathe.

4. When flowers do not appear in clusters, what are they called? *Ans.*—Solitary flowers. Give examples.

5. In flower clusters which are the first to bloom, the innermost or outermost flowers? When the innermost bloom first, the inflorescence is called centrifugal. When the outermost first, centripetal. What do these two words mean?

6. Why are not all flowers arranged on the plants in the same way? *Ans.*—So as to give variety.

7. What does this teach us about God? *Ans.*—His great wisdom.

8. Study as many plants as you can, showing the above arrangements of the flowers.

9. Make drawings illustrating the arrangements of flowers.

References.—"Principles of True Science:" See Flowers. "Parts of His Ways," section 6, chapter 15. Botany, see Flower Arrangement and Inflorescence.

Suggestions to Teachers.—We now come to the study of flowers, which, as well as leaves, develop from buds. The flower is the most beautiful part of the plant, and yet the most transitory. In this lesson the pupils will get some idea of the ways God has of arranging the flowers on different plants. Other ways can be mentioned, but these are the simplest and most common. The teacher should have at least one good book on botany to consult for obtaining the technical terms. You may not find the plants mentioned above in your community; if not, take any plants which will illustrate the modes of arrangement. Remember that botany, to be made interesting and profitable, must be studied mostly out-of-doors. The next lesson is on the Organs of the Flower. Collect for this study the early wake-robin. If this can not be obtained, use the cultivated geranium, morning-glory, or petunia.

LESSON XXIV.

The Organs of the Flower.

1. Take a good look at the flower in hand, and notice its beautiful and delicate structure.

2. How does it compare with a work of art? Matt. 6:28, 29.

3. Of how many parts (organs) does the flower consist, and by what names are they called?

(1) The calyx. This is the little green cup which contains the more beautiful and delicate parts of the flower. The calyx is made up of green, leaf-like bodies called sepals. How many sepals are there?

(2) The corolla. Within the calyx is an envelope of colored, leaf-like bodies called the corolla. Each little leaf is called a petal. How many petals are there in your flower? What is their color? Their shape?

(3) The stamens. By carefully removing the calyx first, and then the corolla, you will discover the stamens, which are slender, narrow, stalked bodies. How many are there? What are their colors? Each stamen consists of two parts,—the smooth stock, called the filament, and the knob on the end, called the anther. What is the color of the filament? Of the anther? Notice a fine yellow powder, called the pollen.

(4) The pistil. Remove part of the stamens, and notice an enlarged body in the center of the flower, called the pistil. What is its shape? The large base of the pistil is called the ovary,

and contains the ovules. The slender portion is called the style. Sometimes there is more than one style. How many are there in your flower? The knob at the end is called the stigma.

(5) The receptacle. This is that part of the pedicel which is enlarged, and on which the calyx and corolla rest.

4. Examine with the microscope all the parts of the flower just studied.

5. Make a drawing of a stamen, showing the filament and anther.

6. Make a drawing of the pistil, showing the ovary, style, and stigma.

7. Make drawings representing the calyx and corolla.

8. What purposes do the various organs of the flower serve?

References.—"Parts of His Ways," section 6, chapter 16. Botany, see Flower, Organs of.

Suggestions to Teachers.—If it were possible to study the flower without tearing it to pieces, it would be much better. But since this can not be done, except with very large flowers, it is proper to dissect the flower.

The pupils should do this, not in a ruthless, careless way, but with a strong desire to learn their structure and the purpose they serve in the growth and development of the plant. If the above-mentioned flowers can not be had, use bellwort, lily-of-the-valley, false Solomon's seal, Solomon's seal, tulip, or hyacinth. Each pupil should have a flower in hand while studying the lesson.

LESSON XXV.

The Purpose of the Organs of Flowers.

1. Name the organs of the flower.

2. What are the calyx and corolla sometimes called? *Ans.*—Floral envelopes.

3. What purposes do the organs of the flower serve? *Ans.*—

(1) The calyx forms a protection to the more delicate parts of the flower within.

(2) The corolla is the most beautiful part of the flower, and delights the eye of man. It also attracts the eyes of insects which are searching for food,—the nectar of the flower.

(3) The stamens contain in the sac-like anthers the pollen dust, which the flower must have in order to produce seed that will grow. The filaments raise the anthers high enough so that the pollen is deposited at the right place.

(4) The pistil contains the ovary, the vessel which holds the ovules. Above the ovary is the style (or styles), which supports the stigma, and upon the stigma is deposited the pollen dust or grains. Each grain sprouts, and sends down through the style into the ovary a little root, which pierces an ovule.

4. What is the object of the pollen roots entering the ovules? *Ans.*—To fertilize them, so that when they ripen into seed they may produce other plants.

5. What is the difference between a seed and an ovule? *Ans.*—The seed is an ovule which has been fertilized by the pollen, and fully matured.

6. Did you ever know of farmers planting seed which would not grow, even under the best of conditions? What was the difficulty?

7. Examine the stigma with your microscope, and see if it is adapted to receive the pollen, and if so, in what way.

8. Make a drawing representing a flower undergoing the process of fertilization.

9. Who planned what the plants should do in order to produce other plants?

10. Are the new plants which spring from the seed, like the mother plant which bore the seed? Gen. 1:11, 12.

11. What lesson does Christ teach us from this law of the seed? Matt. 7:16; Luke 6:44; James 3:12.

12. What law did God give to Israel concerning the mixing of seed? Lev. 19:19. Why?

References.—The same as in lesson 24.

Suggestions to Teachers.—In this lesson the pupils will see how God has constructed the flower that it may produce seed which will reproduce other plants of the same kind. The process of fertilization can be seen with the naked eye, except the sprouting of the pollen grains. A compound microscope magnifying 300 times is necessary for this. Could the school have a microscope, it would be a splendid thing. If the teacher is enthusiastic in his work, and awakens an interest in the pupils to know more of the wonderful works of God, a microscope can be easily procured by small subscriptions. The teacher should lead out by giving a liberal donation, and the children will work with their parents, and in a short time $20 or $25 will be raised to furnish a good microscope, which will be useful in studying all phases of nature.

LESSON XXVI.

The Sexes of Flowers.

1. Of what use are the floral envelopes of a flower?

2. What purpose do the stamens and pistil serve?

3. Could the flower get along without the calyx and corolla and still produce seed? *Ans.*—It could, and yet not as well, for the calyx and corolla protect the more delicate organs—stamens and pistil—from the rain, wind, and some injurious insects.

4. What are the stamens and pistils sometimes called by botanists? *Ans.*—Essential organs. The calyx and corolla? *Ans.*—Non-essential organs. Why?

5. When the Lord created Adam and Eve, what did He create them? *Ans.*—Male and female.

6. Why did God so create them? *Ans.*—That they might be fruitful and multiply. Gen. 1:28.

7. Did God create plants male and female that they might multiply? What part of the flower is male? *Ans.*—The stamens. Why? What part is female? *Ans.*—The pistil. Why?

8. Have all flowers both sexes represented in them? *Ans.*—No. Give a few examples of those which have.

9. Give examples of plants in which both sexes are not represented in the same flower:—

(1) Monœcious plants (one household). These plants bear two kinds of flowers, one having stamens only, and the other having pistils only. The same plant bearing staminate and pistillate flowers, is the reason why it is called monœcious, which means one household. Examples: The castor-oil plant, Indian corn, begonias, walnut, hickory, oak, chestnut, etc.

(2) Diœcious plants (two households). In which each plant has one kind of flowers,—either staminate or pistillate. Such plants are diœcious, that is, of two households. Examples: The willow, early meadow rue, poplar, box-elder, cottonwood, etc.

10. What part of the corn plant is staminate? Pistillate?

References.—"Parts of His Ways," section 6, chapter 17. Botany, see Monœcious and Diœcious Plants.

Suggestions to Teachers.—This is a good opportunity to teach children the difference of sex. That there should be two sexes, not only of man, but also of plants, was the plan of God when He created the world. This is God's method of multiplying and increasing the plant and the animal kingdoms. The Indian corn and willow are good examples, and are quite common everywhere. The pupils should have these plants in hand, if possible, when this lesson is studied. Have them make drawings representing the corn and willow flowers.

LESSON XXVII.

Pollen Distribution.

1. What is pollen? What is its color?

2. When a pollen grain unites with an ovule, what process has been carried out? *Ans.*—The process of fertilization.

3. What is a flower called which has both stamens and pistils? *Ans.*—It is called bisexual,—two sexes, male and female.

4. What is a flower called which has only stamens or pistils? *Ans.*—It is called unisexual,—one sex, either male or female.

5. Into how many classes are the unisexual flowers divided? *Ans.*—Into monœcious and diœcious flowers. Describe each and give examples.

6. How is the pollen transferred in bisexual flowers, such as the apple, plum, bean, pea, etc.? *Ans.*—By the stamens coming in contact with the pistil. This is called close fertilization.

7. How is the pollen transferred in the monœcious and diœcious flowers, such as the corn and the willow? *Ans.*—By cross fertilization.

8. How is the pollen carried across from one flower to another? *Ans.*—

(1) By the wind. Go out into the corn field when the corn is well tasseled and you will see the air filled with the pollen, which is dropping on the silk of the ears of corn. The tassel at the top of the stalk is the staminate flower, while the ear is the pistillate flower.

(2) By insects. Numberless insects visit flowers in search of nectar, and while doing this they carry pollen from one flower to another.

Name some of the common insects which visit the flowers for nectar. What insect visits red clover? White clover?

(3) By birds. The humming-bird is the most frequent visitor to flowers, yet other birds visit them also. Even snails fertilize a few flowers.

9. How are birds and insects attracted to flowers? *Ans.*—By their beautiful colors and fragrant odors.

10. How is the pollen of flowers protected from being soaked and spoiled by dew and rain? *Ans.*—Some flowers are naturally in a nodding position, which prevents the dew and rain entering them. Others open in sunny weather and close at night or during rain.

11. Examine the same flowers in sunshine, during rain, and at night.

12. What have you learned about God in the study of these lessons?

References.—"Parts of His Ways," section 6, chapter 18. Botany, see Fertilization of Flowers.

Suggestions to Teachers.—Have the students carefully observe the points brought out in this lesson. You can give them different insects to observe as they visit the flowers. Give to one a bumblebee, another a honey-bee, another a butterfly, and so on, and have them write descriptions of what they have seen. Again I must urge the teacher to bring his pupils close to the heart of nature, and by so doing he will bring them close to the great, loving heart of God.

LESSON XXVIII.

The Shapes of Flowers.

1. Gather several different kinds of flowers and notice the structure of the corolla. The apple, rose, strawberry, bell-flower, potato, bachelor's button, dead nettle, petunia, morning-glory, are suggested as good examples.

2. What do you notice with reference to their petals?

(1) The monopetalous. When the petals are partially or entirely united, the flower is monopetalous. Examples: The morning-glory and petunia.

(2) The polypetalous. When the petals are entirely separate. Examples: The apple, strawberry, rose.

3. Notice the shapes of the common flowers.

(1) The rotate flowers. This flower is rotate or wheel-shaped. Example: The potato flower.

(2) The salver-shaped. Like the old Roman salver. Example: The phlox.

(3) The bell-shaped. Having the form of a bell. Examples: The harebell and the bluebell.

(4) The funnel-shaped. Shaped like an ordinary funnel. Example: The morning-glory.

(5) The tubular. Have about the same diameter from bottom to top, like an ordinary tube. Example: The trumpet honeysuckle.

(6) The papilionaceous (butterfly shaped). It was thought at one time that this flower looked like a butterfly. Examples: The pea, bean, common locust.

(7) The labiate (lip-shaped). The corolla having a lipped appearance. They are divided into two classes:—

(*a*) The gasping. In which the lips are wide open. Example: The dead-nettle.

(*b*) The masked. In which the wide-open lips are covered with a mask. Examples: The snapdragon and toad-flax.

(8) The ligulate (strap-shaped). In which the petals are long and narrow. Examples: The dandelion, chicory.

4. Why did not the Creator make all the flowers after one pattern as regards shape?

References.—"Parts of His Ways," section 6, chapter 19. Botany, see Flowers, Shape of.

Suggestions to Teachers.—The pupil will become more familiar with these different forms of flowers by making drawings of them. Do not omit the work in drawing, for it impresses the forms more vividly upon the mind. Every teacher will do more efficient work in teaching if he can draw well. If you can not draw, learn this art at your earliest opportunity.

LESSON XXIX.

The Odors and Colors of Flowers.

1. What kinds of flowers have we as regards their petals? *Ans.*—Monopetalous and polypetalous flowers.

2. Give examples of each.

3. Should a flower have but one floral envelope, what kind of a flower would it be called? *Ans.*—Apetalous (no petals), the calyx only being present. Example: The four-o'clock.

4. Give the shapes of flowers, and illustrate each by a common example.

5. Of what value are the odors of flowers? *Ans.*—

(1) Their sweet fragrance delights man.

(2) They also attract insects which would not visit the flowers because so small that they are difficult to find. The night-blooming flowers are more sweet-scented than those which bloom during the day. Why? What is the color of the night-blōoming flowers? *Ans.*—White. Why?

(3) They are used in making perfumes.

6. What purposes do the colors of flowers serve? *Ans.*—

(1) The beautiful colors delight the eye of man.

(2) To attract insects. Do visits of the insects to the

flowers benefit the insect, or man, or both? In what ways?

(3) They serve as models in manufactures.

7. Are all colors represented in the flowers?

8. What colors attract certain insects? *Ans.*—

(1) Dull yellow, brownish, or dark purple flowers, especially if small, are visited mostly by flies.

(2) Red, violet, and blue are the colors by which bees and butterflies are most attracted.

9. Collect flowers representing many different colors, and make a list of them.

10. Make a collection of flowers having an agreeable odor. A disagreeable odor.

11. To what is the great variety of color in flowers due? *Ans.*—To the action of the sunlight. (See lesson 4, chapter 1.)

12. Of what is a plant, bearing beautiful flowers, and giving off sweet fragrance, a fit symbol? *Ans.*—Of the Christian.

13. Did the Lord connect with the Jewish worship beautiful colors and rich perfumes? *Ans.*—The beautifully-colored stones (see lesson 13, chapter 5) and the fragrant incense.

References.—"Principles of True Science:" Flowers in Eden, "Spiritual Gifts," vol. 3, pp. 34, 35; "Patriarchs and Prophets," p. 44; Fragrance Is Like Love, "Mount of Blessing," p. 15; Flowers and Buds, a Study for Children, "Testimonies for the Church," vol. 3, p. 137; "Christian Education," p. 9; Flowers, Lessons of the, "Testimonies for the Church," vol. 3., p. 375. "Parts of His Ways," section 6, chapter 20. Botany, see Flowers, Odors and Color of.

Suggestions to Teachers.—Many beautiful spiritual lessons may be drawn from this lesson. Study the following texts: Isa. 54:11; 2 Cor. 2:15, 16; 1 Peter 3:3-5. It is not expected that any of the lessons can be given in their entirety at one recitation, but the teacher should study carefully and select such parts as can be given. Or two recitations may be given to one lesson, and some of each lesson may be omitted at the discretion of the teacher. Let the teacher be several lessons ahead of the pupils all the time.

LESSON XXX.

Flowers as Symbols.

1. What phases of flowers have you studied? *Ans.*—

(1) The arrangement on the plant.
(2) The organs of the flower.
(3) The use of the organs.
(4) The sexes of flowers.
(5) The fertilization of flowers.
(6) The shapes of flowers.
(7) The odors and colors of flowers.

2. Bring an essay to-morrow telling what you have learned about flowers.

3. In the Word of God what does the flower symbolize? *Ans.*—

(1) The noon-time of life. 1 Sam. 2:33, 34.
(2) The brevity of life. Job 14:1, 2; Ps. 103:15, 16.
(3) The glory of man. Isa. 28:1, 4; 1 Peter 1:24.
(4) Man's goodness. Isa. 40:6-8.
(5) Man's riches. James 1:10-12.
(6) The wicked man is like the olive flower. Job 15:33.
(7) The flowering plants which symbolize Christ:—
 (*a*) The "rose of Sharon." Songs of Sol. 2:1.
 (*b*) The "lily-of-the-valley." *Id.*

4. Who causes flowers to bloom? Num. 17:1-8.

5. What means does God use? Isa. 55:10, 11. *Ans.*—Light, heat, air, water, and soil.

6. What are some of the most important spiritual lessons you have learned from the study of flowers?

7. What lesson do you learn from the fact that flowers always turn their faces toward the sun?

8. Do you think God wants us to love and appreciate the flowers? Why?

Suggestions to Teachers.—This lesson concludes the study of flowers. The next few lessons will be on fruit. Why?—For the flower develops into fruit. We are to study nature in the order of its development. This order was established by God, the Author of nature. When we study nature aright, we shall see beauty in the order of God's working, as well as in the things themselves. The flowers teach many lessons, and these should be impressed upon the minds of the children. The children should cultivate the quiet graces of the flowers, doing their little work where God has placed them just as quietly and faithfully as they. The beautiful flowers tell us that God loves beautiful things. Read "Special Testimonies on Education," pp. 37, 62.

LESSON XXXI.

Fruit.

1. Name the different parts of a flower.
2. Do the parts of a flower continue indefinitely?
3. What parts remain, and what parts are deciduous (fall off)?
4. Into what do the remaining parts of the flower develop? *Ans.*—Into fruit.
5. What definition would you give fruit? *Ans.*—Fruit is the result of a developed or educated blossom. "An apple is an educated apple blossom."
6. The following kinds of fruit illustrate the modes of development:—
   (1) The simple kinds. In which the fruit develops from a single ripening pistil. Examples: The cherry, pea.
   (2) The aggregate kind. In which several pistils unite to form the fruit. Examples: The raspberry, blackberry.
   (3) The accessory kind. In which the calyx or receptacle unites with the pistil to form the fruit. Examples: The apple, strawberry.

(4) The multiple kind. In which several flowers unite to form a single fruit. Examples: The mulberry, pineapple.

7. Watch the blossoms of the apple, cherry, strawberry, pea, bean, currant, rose, and see how long the blossoms remain on the plants.

8. Watch the development of the above flowers and classify their fruit as indicated in No. 6, (1)-(4).

References.—"Principles of True Science:" See Fruit. "Parts of His Ways," section 6, chapter 21. Botany, see Fruit.

Suggestions to Teachers.—The blossoms develop into fruit. The flowering stage may represent the youthful part of life. It is the most beautiful but not the most useful. The fruit is not only beautiful but serviceable as well. Thus, when men and women have passed their blossoming, youthful days, and have developed some fruit of experience and stability, they are of the most value to the world. But there is a time for everything, and for everything its season. (Read Eccl. 3:1-8.) The pupils should do careful work in observing blossoms change into fruit. Select certain plants, which may be visited daily if you wish to secure the best results. Have drawings made to indicate the development.

LESSON XXXII.

Fleshy Fruits.

1. Examine several kinds of fruit and note the differences and similarities between them.

2. You will notice two leading characteristics:—

(1) Soft, pulpy, and juicy fruits. These are called fleshy fruits.

(2) Hard and dry fruits. These are called dry fruits.

3. The following names have been given to the fleshy fruits:—

(1) The berry. This fruit consists of a rather thin skin, and a one to several-celled fleshy ovary and its contents. Examples: The tomato,

grape, persimmon, gooseberry, and currant. In the first three the calyx forms no part of the fruit, while it does in the last two, and in a great number of berries.

(2) The pepo. This fruit is a berry with a hard rind, but fleshy on the inside. Examples: The squash, pumpkin, melon, and cucumber. In the pepo, or gourd fruit, as it is sometimes called, the hard outer rind is formed by the thickened calyx.

(3) The pome. This fruit consists of a several-celled ovary, called the "core." This contains the seeds, which are surrounded by a tough membrane. Around the core is the fleshy, eatable portion, which makes up the bulk of the fruit. This is formed from the much-thickened calyx. What part of the blossom do we eat when we eat the sweet, mellow apple? *Ans.*—The calyx.

(4) The drupe, or stone fruit. This fruit is much like the berry, but part of it consists of a very hard portion, called the stone. This stone is the seed. Examples: The peach, apricot, plum, cherry.

4. Why is the pulp or soft portion of many fruits eatable?

5. Why are the seeds sometimes bitter, as in the orange?

6. Make drawings of the melon, apple, peach. Cut them in two and draw cross-section of each.

References.—"Parts of His Ways," section 6, chapter 22. Botany, see Fleshy Fruits.

Suggestions to Teachers.—This lesson on Fleshy Fruit is one which will be of great interest, provided you so carry on the study that the pupils may actually see the fruit as it develops. Have them watch the strawberry, which consists mostly of an enlargement of the receptacle. The little pistils with their seed may be found on the surface of

the strawberry. The short, dry scales on the end of the apple are the ends of the calyx leaves, which did not swell up and become soft and juicy.

LESSON XXXIII.

Dry Fruits.

1. Name the different kinds of fleshy fruits, and illustrate each one by a common example.

2. What other large class of fruits is there? *Ans.*—Dry fruits.

3. What is the difference between dry fruits and fleshy fruits?

4. Name some of the different kinds of dry fruits.

(1) The akene. This is a small, indehiscent (not opening at maturity) fruit with one seed. It is often mistaken for a naked seed on account of its seed-like appearance. Examples: The buttercup or crowfoot, virgin's bower, sunflower, thistle, lettuce, dandelion.

(2) The grains. This fruit is like an akene with the seed adhering to the thin pericarp throughout, so that the fruit and seed are incorporated into one body. Examples: Wheat, rye, oats, Indian corn, and other kinds of grain.

(3) The nuts. This fruit is usually one-celled and one-seeded, with a hard, crustaceous, or bony wall. The involucre (bracts or leaves of the flower) unites to form a cup at the base, called the "cupule." In the chestnut the cupule forms a bur, while in the hazel, a leafy husk. Examples: The hickorynut, butternut, chestnut, hazelnut, walnut.

(4) The key fruit. Any dry, indehiscent fruit furnished with a wing, or pair of wings. Examples: The elm, ash, maple.

(5) The follicle. A dehiscent (opening at maturity) fruit consisting of a single (simple) pistil, which opens only on the ventral side, when matured. Examples: The marsh marigold, larkspur, peony, milkweed.

(6) The legume or pod. The same as the follicle, except that it opens at maturity on both the dorsal and ventral sides. Each half of the pod is called a "valve." Examples: The pea, bean, locust, vetch.

(7) The capsule. A dry, dehiscent fruit composed of a compound pistil. The seed escapes either through chinks or pores, as in the poppy, or bursts open irregularly, as in the lobelia and snapdragon. But commonly the fruit splits open lengthwise into regular pieces. Examples: The iris, morning-glory, rue.

(8) The silique. The pod of the mustard family.

(9) The pouch. A short and broad silique. Examples: The shepherd's purse, pepper-grass.

(10) The cone. The peculiar multiple fruit of pines, cypresses, and cedars.

5. The fleshy fruits are indehiscent, and the seed becomes free only through decay or by being fed upon by animals.

6. The dry fruits (1)-(4) are indehiscent, and these are so constructed that they are carried about in different ways. Some burst irregularly. The remainder of dry fruits (5)-(10) split open along regular lines and discharge their seeds.

7. Draw a type of each kind of dry fruit mentioned in this lesson.

References.—"Parts of His Ways," section 6, chapter 23. Botany, see Dry Fruits.

LESSON XXXIV.

Fruit as a Symbol.

1. Name the four kinds of fruits based on their modes of development. Give an example of each.

2. Name the two great classes of fruits based on their structure. Give examples of each.

3. What is a fruit?

4. For what purpose did the Creator make fruit? *Ans.*—
   (1) As food for man.
   (2) As food for the lower animals.
   (3) To protect the seed within.

5. Can you name any of the fruit trees God placed in the garden of Eden? Gen. 2:9.

6. What is represented by the fruit of the tree of knowledge of good and evil?

7. What by the tree of life?

8. In the Scriptures what is fruit used to symbolize? *Ans.*—
   (1) Deeds. Prov. 11:30; Luke 3:8; Matt. 7:16, 20.
   (2) The results of acts or deeds. Isa. 3:10; Micah 7:13; Jer. 17:10; 21:14; Gal. 6:7.
   (3) The results of the Spirit working. Gal. 5:22; Eph. 5:9.
   (4) Words fitly spoken. Prov. 25:11.
   (5) Fruit of righteousness. 2 Cor. 9:10; Phil. 1:11.

9. Does God want His children to bear fruit? John 15:8.

10. What are we if we are to bear fruit? John 15:5.

11. Can a branch bear fruit of itself? Verse 4.

12. What really bears the fruit? *Ans.*—The vine.

13. Who is the vine? *Ans.*—Christ.

14. Is the vine dependent upon anything? *Ans.*—The husbandman.

15. Who is the husbandman? *Ans.*—God.

16. Through what means do the fruits of righteousness come into our lives? *Ans.*—Through God and His Son Jesus Christ; through the Word and through the Spirit.

Suggestions to Teachers.—God placed in the earth the fruit trees, which contribute so much to our happiness. But they should remind us continually of what we ought to be,—trees of righteousness, the planting of the Lord, bringing forth the fruits of righteousness. God is not satisfied that we should be simply foliage Christians, but we must also be fruitful Christians.

LESSON XXXV.

Fruit and Seed.

1. With what part of the plant did we first begin our study? *Ans.*—The seed.

2. How many parts of the plant have we considered thus far? Name these parts.

3. What is the work of each of these parts?

4. When the plant has produced the matured or ripened fruit, then what takes place with the plant? With the fruit?

5. What relation does the fruit sustain to the seed? *Ans.*—It contains the seed and protects it in different ways.

6. Describe the ways in which the following fruits protect their seed: The apple, peach, plum, cherry, squash, hickory-nut, hazelnut, chestnut, Indian corn, burdock, milkweed, poppy, iris, morning-glory, and wheat.

7. How many kinds of fruit have we, as regards the escape of the seed from the fruit? *Ans.*—Two. What are they? *Ans.*—Indehiscent and dehiscent.

8. Which of the above fruits are indehiscent? Which are dehiscent?

9. How does the seed in the above-mentioned indehiscent fruit escape? How in the dehiscent fruit?

10. Draw the examples of the dehiscent fruits, showing the way the fruit opens to let the seed escape.

11. For what great object does the plant live? *Ans.*—To bring into the world other plants like itself.

12. While it is working to bring this about, is it so selfish that it fails to be a blessing to the things about it? Mention ways in which it proves a blessing.

13. What lesson can be learned from the plants in this respect? *Ans.*—While we live we should be a blessing to all around us.

References.—"Principles of True Science:" Seed-time and Harvest, unpublished Testimonies. "Parts of His Ways," section 6, chapter 24. Botany, see Dehiscence and Indehiscence of Seed.

Suggestions to Teachers.—Let the student collect fruits of different kinds, and bring them to the school to classify them on the following points: (1) Kind; (2) class; (3) escape of the seed; (4) name. The following illustrates the matter of classification: (1) Kind, simple; (2) class, berry; (3) escape of seed, indehiscent; (4) name, cherry. Have the student note carefully, from this time on, the development of the flower into fruit. The bean, pea, cucumber, melon, etc., will furnish good examples in the garden. Like the plant, we must not be so taken up with some great thing that we desire or expect to do that we forget to be a blessing in many little ways each day.

LESSON XXXVI.

The Scattering of Seed.

1. What means has God provided for shelling the seed out of the fruit?

2. If the seed have a hard shell, as in the case of the hickory-nut, butternut, walnut, etc., how is it opened so that it may bring forth a new plant? Plant some of the nuts, acorns, and date seed, and notice how the hard, bony wall is broken.

3. What means has the Creator provided for scattering seed over the face of the earth? *Ans.*—

(1) By water. The seeds which will not sink are carried great distances on the water. The

coconut-palms are the first trees to appear upon coral islands after they appear above the water. Place several seeds in the water and see whether they will float or sink.

(2) By winds. Many seeds are of such a character that they are readily borne about by the breezes. The seed or fruit is inflated, or has appendages, as hairs or wings. Examples: The milkweed, dandelion, catalpa, thistle, maple, ash, willow. In some cases not only the seeds, but even the whole plant, is moved about by the wind. Some plants, called "tumble-weeds," break off at the roots, and the whole plant goes rolling and tumbling along over the prairies until it is stopped by a fence or some other obstacle. These plants are estimated to carry as many as 200,000 seeds.

(3) By animals. Man and the lower animals help to scatter seed. The outer portion of the fruit may be eaten, but the seeds, being bitter, are thrown away, or the seed shell may be hard and indigestible, and therefore escapes destruction. Many seeds attach themselves to the bodies of animals by their hooks and spines. Examples: The burdock, tick-trefoil, and stick-tights.

(4) By explosion. This is caused by the unequal drying of the fruits, which causes them to warp. While in this condition, if the fruit is disturbed, it suddenly bursts and scatters the seed.

4. Collect several kinds of fruit and classify them according to their manner of dispersion.

5. Make drawings of the following fruits and separated seed: the dandelion, stick-tight, burdock, thistle, catalpa, maple, and ash.

References.—"Parts of His Ways," section 6, chapter 25. Botany, see Seed Dispersion.

Suggestions to Teachers.—We have now concluded the study of the structure of plants in a general way, but shall notice this further in our study of special plants, which will be taken up after the next lesson, Seed as Symbols. The children have become acquainted with the general structure of plants, and will now notice wherein plants are alike and wherein they differ.

LESSON XXXVII.

Seed as a Symbol.

1. What is a seed?
2. For what purpose was the seed created? *Ans.*—
   (1) To reproduce the plant.
   (2) To provide food for man.
   (3) To provide food for the lower animals.
3. Name some seeds and the animals which use them for food.
4. Name some seeds which are used by man as food.
5. In what way is seed used as a symbol in the Scriptures? *Ans.*—
   (1) The seed is the Word of God. Luke 8:11; 1 Peter 1:23.
   (2) The principles of truth sowed in the heart. Matt. 13:18-33.
   (3) Israel was called a "right seed." Jer. 2:21.
   (4) Kingdom of heaven like a mustard seed. Matt. 13:31, 32.
6. What parables did Jesus give upon seed? *Ans.*—
   (1) Parable of the mustard seed. Matt. 13:31, 32.

(2) Parable of the wheat and tares. Matt. 13:24-30, 36-43.

(3) Parable of the sower and the seed. Matt. 13:1-23.

7. What lessons did Christ teach from each of these parables?

8. In Luke 8:11 what does Christ call the seed? Why?

9. Where is the Word of God to be planted? *Ans.*—In the soil of the heart.

10. What is the result of the seed growing in the heart? *Ans.*—The new birth. 1 Peter 1:23.

11. What causes the seed to grow?

12. What does the root symbolize in the Word of God? The stem? Branch? Buds? Leaves? Flowers? Fruit? Seed? Give a text in which each of the above is used as a symbol.

Suggestions to Teachers.—In this lesson the teacher should review each part of the plant as a symbol of truth. After this lesson we shall take up the study of common, familiar plants, giving the pupils an idea of how individual plants should be studied. In the past lessons the pupils have learned to know the parts of a plant. In the following lessons the pupil will study these parts and note the differences and similarities in the structure of various plants. Do not take up the study of many plants in a hurried way, but study a few from the garden, from the fields and woods, in a thorough way. Teach the child to study plants in just the way you want him to carry it on all his life.

LESSON XXXVIII.

The Lily Family.

THE TRILLIUM OR WAKE-ROBIN.

The trillium is commonly known as the wake-robin, three-leaved nightshade, and birthroot. Trillium comes from a Latin word meaning triple, which has reference to the triple arrangements of its parts. It is a beautiful plant, and a good representative of the lily family. The bellwort, lily-of-the-

valley, false Solomon's seal, Solomon's seal, asparagus, any true lily, tulip, dog-tooth violet, onion, and hyacinth are near relatives of the trillium.

There are many kinds of trilliums, and these are quite generally distributed throughout the United States. It is easily recognized by its naked stem from four to twelve inches in height, bearing a whorl of three broad, netted-veined leaves and a single flower. The real stem is an underground rootstock, which sends up each year a single branch, which dies at the close of the season.

The trillium is a typical flower to study; it has the two floral envelopes, calyx and corolla, and the sexual organs, stamens and pistil. The parts of the flower are arranged in sets of threes. Most specimens grow in rich, damp woods, and bloom in the early part of May, the time varying slightly with the locality and season. The entire lily family numbers about two thousand species, and is found in all climates. Some of them are food plants, such as the onion, leek, garlic, and asparagus. Some of them are our most beautiful ornamental plants, such as lily-of-the-valley, crown imperial, day lily, hyacinth, tuberose, and tulip.

References.—"Principles of True Science:" See Lily. "Parts of His Ways," section 6, chapter 26. Botany, see Liliaceæ, or Lily Family, and Trillium.

Questions and Suggestions.—What are some of the common names of the trillium? What does the word trillium mean? To what family does it belong? Mention some of its near relatives. Where does it grow? Describe the plant as to its parts,—root, stem, leaves, flowers, fruit, and seed. How many species of plants in the lily family? Of what value is the trillium? Name some of the ornamental plants. If a trillium can not be secured, study one of the other examples mentioned above. If you can not obtain any member of the lily family, pass on to the study of the next lesson. The outline for study given below is to be used in the study of all plants, so the past lessons from 11 to 33 should be carefully reviewed from time to time. The pupils are now to apply the knowledge gained in past lessons, to the plants studied in the following lessons.

OUTLINE FOR STUDY.

1. Plant as a whole:—
   (1) Location. Where the plant in hand was found, its general surroundings, kind of soil in which it grows, etc.
   (2) Distribution. The general distribution of this and related species throughout the states and the world.
2. Parts of the plant:—
   (1) The root. (Study lessons 9 and 10.)
   (2) The stem. (Study lessons 11-14.)
   (3) The branches. (Study lesson 15.)
   (4) The buds. (Study lessons 16 and 17.)
   (5) The leaves. (Study lessons 18-22.)
   (6) The flowers. (Study lessons 23-29.)
   (7) The fruit. (Study lessons 31-33.)
   (8) The seed. (Study lessons 35 and 36.)
3. Economic value. The value of the plant from a commercial point of view or in any other way.

LESSON XXXIX.

The Rose Family.

THE APPLE.

The apple tree is a native of Europe, but is now cultivated in nearly all parts of the world. The wood of the apple tree is hard and tough, and seems well adapted to nearly all climates. The species and varieties of the apple are very numerous. All are acquainted with the wild and the cultivated crab-apples, which are found nearly everywhere. Some of the near relatives of the apple are the pear, peach, plum, cherry, apricot, and the rose. The apple blossoms in the spring. The

parts of the flowers are arranged in sets of fives. The apple blossom has five sepals, five petals, and five pistils. There are many stamens, which are unequal in length. While the apple agrees with the cherry in the number of petals and sepals, yet the latter has but one pistil instead of five.

Notice that in the cherry the ovary remains distinct from the calyx, while in the apple the calyx unites with the pistils, which accounts for the difference in the appearance of their fruits. Compare an apple and a cherry. Examine the wild rose, and notice that it has five petals and five sepals, like the apple and cherry. All of the above-mentioned plants have similar flowers, and the rose has the honor of representing the entire family; hence the name, "rose family."

What could we do without this large family of fruit producers? We would have no apples, pears, peaches, plums, cherries, nectarines, apricots, almonds, strawberries, etc. The rose family furnishes the great bulk of the fruit on the market, and I am sure we would miss it should it fail us for but one season. Study the apple in harmony with the outline given in the previous lesson. The flowers are fertilized by insects, as you will observe on a bright, sunny day.

References.—"Parts of His Ways," section 6, chapter 27. Botany, see Rosaceæ, or Rose Family, and Apple.

Questions and Suggestions.—Notice the apple trees in your orchard. What is their average height? Describe the bark. What is the mode of branching? (See lesson 15.) Notice the grain of the wood. Notice the annual rings. Does the stem grow rapidly? What is the shape of the leaves? Venation? Simple or compound? Rough or smooth? Color of the flowers? Shape? Number of petals? Sepals? Stamens? Pistils? Compare the apple, plum, and cherry as to the parts of the flower and the relation of the parts. Name relatives of the apple. To what family do all these plants belong? What can you say as to the economic value of the plants of the rose family? Classify the fruits of the above-mentioned plants. (See lessons 31 and 32.) Make a drawing of the apple flower. Draw separately the parts. Draw a cross-section of the stem. What is the mode of fertilization? In these lessons the teacher should have, at least, some flowers of the apple, cherry, and plum, and as many other kinds as he can obtain. Have

some of the fruits, if possible, also. If you have not the apple flowers at hand, then study either the cherry or plum. Place the outline for study, in the previous lesson, on the board, so that the order of recitation may be constantly before the pupils.

LESSON XL.

The Rose Family (Continued).

THE STRAWBERRY.

The strawberry is another member of the rose family, and deserves special study. This plant is found over a wide range of country in its wild state; in fact, it extends around the globe. Captain Cook speaks of fine strawberries found in great abundance in Kamchatka and Alaska. The first mention we find of the strawberry is in a poem written in the days of Henry VI of England, in 1435.

The strawberry is a low plant, which sends out long branches, called runners, so that a single plant covers considerable ground. The plant has an underground stem, from which rise the flower stalks and petioles of the leaves. The leaves resembles somewhat those of the rose.

The flower has a concave calyx deeply cleft, with five alternating bractlets. There are five large, white, obcordate petals. There are many stamens and pistils. The small pistils ripen and are known as the seed, which lie naked on the surface of the heart-shaped, pulpy, eatable receptacle. The flowers appear in April, and the fruit ripens in May, June, and July. The strawberry runners send roots down into the ground every little way, and thus propagate new plants. There are about 400 varieties of strawberries. The strawberry is a delicious fruit for dessert or for preserving. The market for the strawberry must be local on account of its perishable nature.

References.—Botany, under Rose Family see Strawberry, Raspberry, and Blackberry.

Questions and Suggestions.—Where does the wild strawberry usually grow? Has the strawberry a stem? What kind? What kind of roots? Do fruit growers pay any attention to the runners? Make a diagram showing how the runners produce new plants. Draw a single plant with one runner. Compare the leaves of the strawberry with those of the rose, part by part. Compare the upper and lower surfaces of the leaves. Describe the leaves as to kind, veins, general outline, and margin. Compare the strawberry flower with that of the rose, apple, cherry, and plum. Compare the fruit of the strawberry with that of the rose fruit. How are the flowers fertilized? Ask your gardener, if you can not tell. To what family does the strawberry belong? The pupils should review the lessons on the parts of a plant (lessons 9-34), until they can readily describe any common plant. Have them study the plants in their natural surroundings. The questions and suggestions are only suggestive; the teacher must enlarge upon them.

LESSON XLI.

The Violet Family.

THE COMMON BLUE VIOLET.

The common blue violet is well known to almost every one, and is a favorite with many. Early writers on plants mention the violet on account of its beauty and delicacy. It was the favorite flower of the Empress Josephine and of Napoleon Bonaparte, and was the flower of the court.

About ninety years ago the violet was brought to the attention of English florists, by Mary Bennett, the daughter of the Earl of Tankerville, who, aided by her father's gardener, produced several seedling varieties, the flowers of which were greatly enlarged and beautified. From this beginning the plant has been changed into the beautiful pansy of the present day. Wild plants have so degenerated that they have lost much of their beauty. But some, even yet, will respond to the efforts of the industrious gardener, and develop into plants of greater beauty. (Read Gen. 2:15.)

The common blue violet grows six to twelve inches high. It grows in moist, rich soil, and will be found more abundant on the banks of small streams. It has a matted, fleshy rootstock, which sends up several long flower-stalks and leaf-petioles. The leaves are heart-shaped, rolled in at the base, and bean-shaped, being slightly toothed. The corolla is not as regular as in the apple, strawberry, cherry, plum, etc. The petals are five in number, but are not all of the same size and shape. The flowers are large and blue, except the later ones, which have no petals at all. These are the flowers which produce the seed. They are self-fertilized, and are not visited by insects.

The common blue violet has a very wide distribution. It may be found in the temperate zone from Maine to California. Some of the near relatives of the common blue violet are the common yellow violet, English violet, dog-toothed violet, hand-leaf violet, and the pansy. All the different species and varieties constitute the violet family. The violets blossom from April to July. The violets are used as medicine, for coloring, and for perfume.

References.—"Parts of His Ways," section 6, chapter 28. Botany, see Violaceæ, or Violet Family, and Pansy.

Questions and Suggestions.—Tell something of the history of the violets. How does the violet resemble the apple, strawberry, plum, etc.? How does it differ from them? Where are they found? How widely are they distributed? What kind of stem does the common blue violet have? What is the color of the flower? How many stamens has it? Where are they attached? Is the ovary free? How is the flower fertilized? What kind of fruit has it? What are some of the uses made of the violet? Draw an entire plant. Collect a sufficient number of common blue violets, roots and all. Collect other species if possible, and some pansies. The roots should be clean-washed and kept moist until used. Have the students write short descriptions of each plant after it has been studied in the class. The next lesson is on the Grass Family, but before taking up the study of grasses, you can study the pod family and cabbage family if your time will allow.

LESSON XLII.

The Grass Family.

INDIAN CORN.

Every one is familiar with the corn plant, but even though it is very common, it is quite difficult to study. Indian corn, or maize, as it is sometimes called, is thought to be a native of North America. Columbus introduced it into Spain in 1520, twenty-eight years after the discovery of the New World. In a very short time it spread over Europe, northern Africa, and western Asia. It is found in the mounds of the Mississippi. C. Darwin found it buried with shells fifty-five feet above tide-water. It is nowhere found wild, propagating itself. Corn grows best in a light, rich loam soil.

The Mississippi Valley furnishes a rich soil, where abundant crops are grown from year to year. The corn yield ranges from thirty to forty bushels per acre in the Atlantic States, and fifty to eighty in the Mississippi Valley.

The corn is a monœcious plant, having both staminate and pistillate flowers on the same plant. The staminate flowers grow at the top of the stalk, and are commonly called "the tassel." The pistillate flowers consist of from one to three spikes (ears), which grow in the axils of the leaves. Each kernel of corn is developed from a single flower. The pistillate flowers are inclosed by spathe-like bracts (leaves), called husks. The styles are long threads, which extend beyond the husks and hang down. They are commonly spoken of as the "silk" of the corn. The leaves are linear-lanceolate and parallel-veined. They are from two to four feet in length, and two to four inches broad.

The fruit is a flat, kidney-shaped or wedge-shaped seed, arranged in rows on the cob. The cob is from five to twelve inches in length. The number of rows of seed on a cob

15

varies from eight to fourteen, and the number of seeds in a row from twenty to fifty. Corn is very useful as an article of food for man, cattle, horses, sheep, and swine. Large quantities of starch are manufactured from it. Corn belongs to the grass family, and is a very near relative to other very useful grains, such as wheat, oats, rye, barley, etc.

References.—"Parts of His Ways," section 6, chapter 32. Botany, see Corn or Maize.

Questions and Suggestions.—Give the history of Indian corn. Where in North America is it most prolific? What kind of soil is best for corn? What is an average yield per acre? How is it usually planted? How is it harvested? Describe the flowers of the corn. Describe the fruit. Describe the leaves. Of what value is Indian corn? Draw an entire plant. Describe the root. Did Joseph know about corn? Did Sampson? This closes the study of individual plants. Other plants may be studied if the teacher so desires. The past few lessons will serve to illustrate how plants should be studied.

LESSON XLIII.

Some Common Trees.

THE SUGAR MAPLE.

The sugar maple has not a very large geographical range. It does not flourish south of 38° north latitude, except in high mountains. By this it is seen that a cold climate is most favorable to its growth. It abounds in the northern parts of the United States and in southern British America. It is also cultivated for shade trees in cities. The sugar maple is sometimes called by the names rock maple and bird's-eye maple. The flowers are arranged in corymbs, and appear with the leaves. The calyx is bell-shaped; the corolla has five petals, but is often entirely absent. The leaves have from three to five lobes, pale or whitish beneath. The fruit is about one inch long, and is winged.

A variety of the sugar maple is called black maple. It differs from the sugar maple in that it has darker leaves and a

rougher bark. Both of these maples yield a rich sap, from which sugar is made. In the early spring, when the sap is ascending, the tree is tapped on the trunk near the ground. Through tubes driven into the tree, the sap flows out into pails or buckets. The sap is gathered into a large pan and evaporated by heat to a syrup. A tree will yield from two to four pounds each year, and will continue to do this for forty years without injury to the tree. By further boiling the syrup it is changed into sugar.

The sap of the sugar maple has been used by mankind during more than a century. The United States yields about 30,000,000 pounds of maple sugar annually; the entire production is about 45,000,000 pounds. No record is found of the manufacture of maple sugar until after the settlement of northeastern America. It is, therefore, supposed that its manufacture was begun by the early settlers of the French and British colonies of this continent.

The wood of the sugar or rock maple is very valuable. It is used in making axles for carriages. It is largely used also in making school furniture, bedsteads, table legs, and chairs. It furnishes the cabinet-maker with the beautiful curled or bird's-eye maple. It is also excellent material for fuel. Near relatives of the sugar maple are the white or silver maple, and the box-elder, often called the ash-leaved maple. The flowers of the relatives of the sugar maple appear before the leaves, and are arranged in umbels. The flowers of the maples are usually polygamous or diœcious.

(See chapter 6, lesson 26, Sexes of Flowers.)

References.—"Principles of True Science:" See Trees. "Parts of His Ways," section 6, chapter 32. Botany, see Aceraceæ, or Maple.

Questions and Suggestions.—Describe the general appearance of the sugar maple. Where does it grow? What are some of the common names by which it is called? How are the flowers arranged on the tree? Describe the flowers. The fruit. Of what use is this tree in cities? Describe the leaves. Name a variety of the sugar maple. How does it differ? Of what economic value is the sugar maple? Describe the process of sugar making. How much is produced annu-

ally in the United States? Who first began its manufacture? When? In what other ways is rock maple valuable? Name the near relatives of the sugar maple. What kind of flowers do they bear? If the maple is not convenient for study and observation, then study any common tree in your locality. Study more than the maple if time will permit. The oak, elm, ash, cottonwood, and willow are suggested.

LESSON XLIV.

Plants with No Flowers.

All plants studied so far bear flowers, but there are a great many which do not bear flowers. We shall not study these carefully now, but simply refer to some of them, so that you will recognize them when you see them. The flowerless plants greatly outnumber those which bear flowers. You may be surprised when I tell you where they grow and how very small some of them are. On the bottom of a watering-trough, and at the sides, you will see green, slimy-looking material, which is called oscillaria, because it oscillates or swings to and fro in the water. With the oscillaria, we often find some protococcus and nostoc. The first means simple berry, and consists of a cluster of green, berry-like bodies. The nostoc looks much like a string of beads.

The green slime which you see on stagnant water, called "pond scum," is another beautiful plant. Mingled with the pond scum we find beautiful boat and crescent-shaped bodies, called diatoms and desmids. All of these plants live in the water, and are rather repulsive to the ordinary observer. But take a little of the scum and place it under a compound microscope, and it presents a most beautiful scene. Swimming about among these microscopic plants may be seen myriads of little animals which feed upon the plants. These small creatures—the amœba, slipper-animals, bell-animals—will be considered in the chapter on Water Animals.

The dreaded germs which cause so much sickness are exceedingly small plants which get into the system with the impure water and air. Diphtheria, scarlet fever, smallpox, malarial and typhoid fever, etc., are some of the diseases caused by bacteria or germ plants. Mold is another very common flowerless plant, which grows luxuriantly in damp places.

All are acquainted with a large class of plants called fungi. Familiar examples of these are toadstools, mushrooms, puffballs, and lichens; the latter you will find growing on decaying logs, stumps, fences, and even on living trees. Toadstools, puffballs, and many other flowerless plants thrive only on decaying organic matter. The mosses and ferns are higher orders of the flowerless plants. They are found growing in the woods where the soil is rich and shaded. Some ferns bear flowers, thus connecting the flowerless plants with those which bear flowers.

References.—"Principles of True Science:" Lichens on Rocks, "Testimonies for the Church," vol. 4, p. 196. "Parts of His Ways," section 6, chapter 34. Botany, see Cryptogams, Ferns, Moss, Fungi, and Diatoms.

Questions and Suggestions.—What kind of plants have you studied thus far? What other large class of plants is mentioned in this lesson? Name some of these plants and describe their general appearance. Where do they grow? What plants are the cause of much sickness? Name some of the diseases caused by them. Do you think the Creator made the flowerless plants? Were they known back in the time of the Israelites? Read the instruction the Lord gave regarding the leprosy of the house and compare it with some of the molds and rots. Which flowerless plants are the most beautiful to the naked eye? Which stand next to the flowering plants? It seems very proper, before leaving the chapter on Plants, to give the pupils an introduction to the large class of flowerless plants, which have not been noticed in any of the previous lessons. You can not take time to study their growth and structure, but merely suggest that at some future time these plants will be open for their study. Let them make a collection of different kinds of molds, toadstools, puffballs, mushrooms, mosses, and ferns, as they have opportunity.

LESSON XLV.

Plants as Symbols.

1. Name the parts of a plant.
2. Name the parts of a flower.
3. What do the parts of the plant symbolize?
4. Is the plant as a whole used as a symbol in the Scriptures?
5. What plants are so used? What do they symbolize?

Ans.—

(1) Israel is represented by a degenerate vine. Jer. 2:21; Ps. 80:8.

(2) The righteous are represented by a tree. Ps. 1:1-3; Jer. 17:7, 8.

(3) The righteous are represented by the palm and cedar. Ps. 92:12-14.

(4) The wicked are represented by the heath in the desert. Jer. 17:5, 6.

(5) David compares himself to a green olive tree. Ps. 52:8.

(6) David prayed "that our sons may be as plants." Ps. 144:12.

(7) A tame olive tree represents Israel, and the wild tree the Gentiles. Romans 11.

6. What does Isaiah say that the children of the Lord shall be called? Isa. 61:3.
7. What will become of those whom the Lord has not planted? Matt. 15:13.
8. What will be their condition when the Lord does this? Mal. 4:1.
9. Name the plants you have studied thus far.
10. Are there many more left for your study? How many?

11. Does the Lord want you to study the plants He has made? Matt. 6:28. Why? Verses 29-31.

12. What person, spoken of in the Bible, studied plants? *Ans.*—King Solomon.

13. How many did Solomon study? 1 Kings 4:33.

14. Did Solomon study plants only? 1 Kings 4:29-34; Eccl. 1:13.

Suggestions to Teachers.—This chapter on plants will close with the next lesson, on the Garden of Eden. If you have succeeded, in the study of plants thus far, to awaken in the hearts of your pupils a deeper love for God and for the beautiful things He has made, your work has been a success. The pupils will not drop the study, but will continue during vacations to observe the plants and flowers which grow about them. Here we can only begin the study of plants; we shall continue the study through eternity. Adam and Eve studied the plants. "They held converse with leaf and flower and tree, gathering from each the secrets of its life." "Christian Education," p. 207; "Patriarchs and Prophets," p. 51.

LESSON XLVI.

The Garden of Eden.

1. Out of what did God create the plants? Gen. 1:11-13.

2. How many classes of plants did He create?

3. What preparatory work did the Lord do before creating plants? Gen. 1:3-10. Was this work necessary? Why?

4. Was the creating of plants necessary to the work which was to follow? *Ans.*—They were to be food for the creatures which were brought into existence on the fifth and sixth days.

5. Where have we a further account of the plant creation? Gen. 2:8-17.

6. What did the Lord plant on the third day? *Ans.*—A garden. Gen 2:8.

7. Where was this garden planted? *Id.*

8. Out of what did the Lord form the plants which were placed in this garden? *Ans.*—Out of the ground. Gen. 2:19; 1:11.

9. What kind of trees did the Lord plant in the garden of Eden? Verse 9.

10. What particular trees are mentioned? *Id.*

11. Where were they located? *Id.*

12. How was the garden watered? Verse 10.

13. Into how many branches was this river divided? *Id.*

14. Name the four rivers and the countries watered by them.

15. What metal and precious stones were in the land of Havilah? Verse 12.

16. Whom did the Lord place in the garden? Verses 8, 15. For what purpose? *Id.*

17. Were any living creatures besides man placed in the garden? Verses 19-25. (Read chapter on Creation, in "Patriarchs and Prophets.")

18. How do you think the garden of Eden would compare with the nicest parks of our day?

References.—"Principles of True Science:" See Garden of Eden. "Parts of His Ways," section 6, chapter 35.

Suggestions to Teachers.—Undoubtedly the garden of Eden was created on the third day, so that Adam and Eve, as soon as they were created, found a beautiful home in readiness for them. The teacher need not dwell at length on the garden, as we shall refer to it again when we complete the study of creation. In our study thus far we have concluded the study of the first three days' work. The light is flooding the earth; the clouds are borne about by the gentle breezes; the atmosphere is pure and sweet; the whole earth is clothed in living green; but yet the work is not complete. God now places bright luminaries in the heavens, which have a work to do in controlling the seasons and thus affecting plant life. So the next chapter will be on the work of the fourth day,—the creation of the sun, moon, and stars.

Chapter VII.

THE SUN, MOON, AND STARS.

(Scripture Basis, Gen. 1:14-19.)

LESSON I.

The Light and Heat Givers.

1. What was the last act of creation on the third day? *Ans.*—The creation of plants.

2. What were the first things that God created which are absolutely necessary to plant growth? *Ans.*—Light, heat, air, water, and soil.

3. On what days were they created?

4. Was the light which God made on the first day a permanent light?

5. What was done on the fourth day in the matter of establishing permanent light and heat for the plant creation? Gen. 1:14, 17.

6. What light-bearing bodies did God make? Verse 16. *Ans.*—The sun, moon, and stars.

7. In what way are the sun and moon distinguished from the stars? *Ans.*—They are spoken of as two great lights. *Id.*

8. Which is the greater light? What work did God give it to do? *Ans.*—To rule the day. *Id.;* Ps. 136:7, 8.

9. What were the lesser light and the stars to do? *Ans.*—To rule the night. *Id.;* Ps. 136:9.

10. Besides giving light and heat upon the earth, what other purposes were they to serve? *Ans.*—

(1) Divide the day from the night. Gen. 1:14.

(2) For signs. *Id.*
(3) For seasons. *Id.*
(4) For days. *Id.*
(5) For years. *Id.*

11. What makes a day? A year?

12. What causes the seasons?

13. Have there been signs in the sun, moon, and stars? Luke 21:25; Matt. 24:29.

14. What is meant by "ruling the day" and "ruling the night?"

15. Write a short essay telling the influence the sun has upon plants and animals during the day, and the influence of the moon at night. Deut. 33:13, 14.

References.—"Principles of True Science:" Sun to Rule the Day, "Testimonies for the Church," No. 32, p. 68. "Parts of His Ways," section 7, chapter 1. Astronomy, see Sun and Moon.

Suggestions to Teachers.—We now enter upon the study of the fourth day's work. God set apart two heavenly bodies to give light upon the earth. The light and heat which they should give to the earth would cause plant and animal life to spring forth abundantly. These lights were to regulate the seasons. They were to measure the time. They are God's great clock hung in the sky to measure off the day, the week, the month, and the year. The plant life which God started on the third day grew rapidly under the influence of the great lights.

LESSON II.

Gravitation.

1. How were all the heavenly bodies brought into existence? Ps. 33:6, 9; 148:3-5.

2. How are the worlds kept in their places in space? Heb. 1:3; Col. 1:16, 17.

3. What name do scientists give to this power which holds things together? *Ans.*—Gravity.

4. Give examples of the working of God's power, called gravity.

(1) Bodies thrown up from the earth are attracted to it again by gravity.

(2) Gravity holds the planets in their orbits as they move about the sun. This may be illustrated by tying a string to a stone, and swinging it about one's head. The stone will represent one of the planets, and the string will represent gravity.

5. Who discovered the law of gravitation? *Ans.*—Sir Isaac Newton. When? *Ans.*—1682.

6. What circumstances were connected with the discovery of this law? *Ans.*—Newton, a young man of twenty-four years, was spending the summer of 1666 in the country, on account of the plague which prevailed at Cambridge, his place of residence. One day, while sitting in the garden, an apple chanced to fall to the ground near him. Reflecting upon the strange power which causes all bodies thus to descend to the earth, and remembering that this force continues, even when we ascend to the tops of the highest mountains, this thought occurred to his mind, "May not this same force extend to a great distance in space? Does it not reach the moon?" With great patience and perseverance, Newton sought to solve the problem of gravitation. When at last he saw that the result of his figures was the correct answer, he was so overpowered by the thought of the mighty truth he had discovered, that his hand faltered, and he called upon a friend to complete the computation.

7. Whose power attracts objects toward the earth?

8. Whose law, then, is it which Newton discovered? *Ans.*—God's.

9. Give the law which Newton discovered with reference to the attraction of two bodies. *Ans.*—"Every particle of matter in the universe attracts every other particle. This is directly

as the mass and indirectly as the square of the distance through which it acts."

10. In harmony with the above law, what will a body weigh at the center of the earth? What would a body weigh two thousand miles below the surface, if it weighs one hundred pounds at the surface of the earth? What would it weigh four thousand miles above the surface? What would it weigh eight thousand miles above the surface?

11. What machines have men invented to lift objects against the force of gravity? *Ans.*—The lever, pulley, inclined plane, and screw.

12. Who gives men ability to make useful inventions? How should they use it? Sp. T. Ed., p. 8; Ex. 36:1, 2; 35:35.

References.—"Principles of True Science:" Creation Upheld by God's Power, "Patriarchs and Prophets," p. 115; "Christian Education, p. 195; Universe Upheld by Creative Energy, "Special Testimonies on Education," p. 58. "Parts of His Ways," section 7, chapter 2. Astronomy and Physics, see Gravitation and Gravity Machines, Lever, Pulley, and Inclined Plane.

Suggestions to Teachers.—This lesson is to fix in the minds of the pupils the fact that the power called gravity is the power of God, and that He holds things together, and does so in a uniform and orderly way. Newton discovered one of the many laws of God by which He rules the universe. Kepler discovered three of God's laws relative to the movements of the planets. Instead of taking glory to himself, and calling the laws his own because he discovered them, he said with deep reverence and humility, "O God, I think Thy thoughts after Thee."

LESSON III.

Magnetism.

1. What really is the force of gravity? *Ans.*—It is a manifestation of the power of God, not only in holding things on the earth, but in sustaining suns, stars, worlds, and systems in their orbits around God's throne, the center of the universe. G. C., p. 677.

2. How does Isaiah speak of the starry world? *Ans.*—As a host. Isa. 40:26. How many stars appear to the naked eye at night? *Ans.*—About six thousand. How many more can be seen with the telescope? *Ans.*—Several millions.

3. Does God know the number of the stars? Ps. 147:4, 5; Isa. 40:26. Does He know their names? *Id.*

4. What other forces in nature are similar to gravity? *Ans.*—Magnetism and electricity.

5. Where does magnetism manifest itself? *Ans.*—In an iron mineral, called magnetite or lodestone.

6. What is a magnet? How is it made? *Ans.*—By bringing a piece of iron or steel in contact with a piece of lodestone, or with something that has already been magnetized.

7. Take a straight steel bar of iron and magnetize it by placing it on the armatures of the dynamo in some electric plant. After it is magnetized, place it on the table, under a pane of glass. Sprinkle slowly some fine iron filings over the magnet; at the same time keep tapping the glass with the other hand, so as to cause the particles to vibrate. Make a drawing of what you see after this work is done. You will notice that the little grains of iron arrange themselves in lines, showing the direction of the magnetic force.

8. What are the ends of the magnetic bar called? *Ans.*—The poles. What names are given to the poles? *Ans.*—Positive and negative poles.

9. Magnetize a needle and suspend it horizontally by a thread. Now bring one end of the bar toward the needle. What is the result?

10. How can we tell which end of the bar magnet or needle magnet is positive, and which negative? *Ans.*—The end of the needle which points toward the north is positive, and the end of the bar is positive which repels the end of the needle which points toward the north. The opposite end is negative.

Like poles repel, and unlike poles attract. Prove this by using two magnets.

11. Will magnetism pass through a substance? *Ans.*—Place a pane of glass between the bar and the needle. Place a book between them.

12. In what ways has magnetism been utilized so as to be useful to man? *Ans.*—In the mariner's compass, used on ships at sea; and in connection with various electrical machines.

13. Who is the great spiritual magnet? *Ans.*—Christ. John 6:44; 12:32.

14. Through what spiritual forces does Christ draw men? Jer. 31:3. *Ans.*—Through love, mercy, kindness, etc.

References.—"Principles of True Science:" See Magnet. "Parts of His Ways," section 7, chapter 3. Physics, see Magnetism.

Suggestions to Teachers.—A passing notice simply may be given to the subject of magnetism; but it comes in here naturally, in connection with the subject of gravitation. The experimental work in this lesson is very simple, and will add very much to the interest of the lesson. The children, like the magnet, are to have a drawing influence for Christ. Matt. 12:30.

LESSON IV.

Electricity.

1. What forces in nature have we studied in the last two lessons?

2. Who is the author of these forces? Rom. 13:1; Ps. 62:11.

3. What else belongs to God as well as power? Ps. 62:12.

4. What other force is there in nature similar to gravity and magnetism? *Ans.*—Electricity.

5. In what ways may it be generated? *Ans.*—

(1) Rub the feet along on a Brussels carpet, then bring the forefinger up to a piece of metal. A spark of electricity will pass out from the finger into the metal.

(2) Rub briskly a glass rod, or bottle, with a piece of silk; then bring it near some bits of paper, or to some pith-balls, suspended by threads from a glass rod.

(3) Rub a stick of sealing-wax with a piece of flannel, and bring it near the pith-balls.

(4) Comb the hair, when dry, with a rubber comb, and bring it near the pith-balls.

(5) Take a small piece of paper, and heat it for a moment over a lamp; draw the paper quickly, two or three times, between the coat and coat sleeve, then place it against the side of the wall. What takes place?

6. What do we call the electricity generated by the above methods? *Ans.*—Frictional electricity. Why?

7. What other kind of electricity is produced? *Ans.*—Voltaic electricity, named after Volta, the man who discovered the mode of generating it.

8. How is voltaic electricity generated? *Ans.*—Obtain from the hardware store strips of copper and zinc, each one inch wide and six inches long. Place these in a tumbler two-thirds full of a solution of either sulphuric or hydrochloric acid and water. There should be six parts of water to one of the acid. Connect the upper ends of the copper and zinc with a piece of copper wire three feet long. When complete, you have a simple electric battery.

9. In what ways is electricity serviceable? *Ans.*—It is serviceable in treating the sick, and in running machinery. Name and describe some electrical machines.

10. Why, right at this time, have such wonderful discoveries been made in science? *Ans.*—So that means may be provided for carrying the gospel rapidly to every creature.

References.—"Principles of True Science:" See Electricity. "Parts of His Ways," section 7, chapter 4. Physics, see Electricity.

Suggestions to Teachers.—It may be impossible to perform all the experiments in one lesson, but some of them can be worked in with lessons which do not call for experiments. A machine for indicating whether electricity is positive or negative is easily made. Through a rubber cork run a piece of wire which has a loop above the cork and the two ends free below. Insert two narrow strips of tissue paper between the free ends of the wires. Now insert the cork, with the wire and the tissue paper, into a dry bottle. Bring the electrified glass rod, comb, sealing-wax, etc., to the loop of the wire, and see what the result is on the tissue paper. Do all electrified bodies contain the same kind of electricity? The glass rod has positive electricity. What do the others possess? That like signs (or poles) repel, and unlike signs attract, is just as true with electricity as with magnetism. Prove this with your electroscope.

LESSON V.

The Solar System.

1. Are there other worlds besides the one on which we live? Heb. 1:2.

2. Name some of these worlds. *Ans.*—Mercury, Venus, Jupiter, Uranus, and Neptune.

3. What do astronomers call these worlds and the one on which we live? *Ans.*—Planets.

4. What does the word "planet" mean? *Ans.*—Wanderer. Planets were so called because the ancients noticed that these stars wandered about among the other stars.

5. About what center do the eight planets mentioned travel? *Ans.*—About the sun.

6. Have the planets other bodies revolving about them? What are they called? *Ans.*—Moons.

7. Name the planets which have moons, giving the number of each. *Ans.*—Mars has two moons; Jupiter, five; Saturn, eight; Uranus, four; Neptune, one.

8. Are there any other bodies revolving about the sun besides the planets, with their moons? *Ans.*—Several hundred small bodies, called "asteroids," have been discovered moving in the space between Mars and Jupiter.

9. What do astronomers call the sun and the large number of planets, moons, and asteroids which move about it? *Ans.*—The solar system, which means the system of the sun.

10. Does the solar system occupy much space? *Ans.*—This question can be best answered by finding out how far the planets are from the sun. The following is the order of the planets, going from the sun outward, with their respective distances: (1) Mercury, about 37,000,000 miles from the sun; (2) Venus, 67,000,000; (3) Earth, 93,000,000; (4) Mars, 140,000,000; (5) Jupiter, 480,000,000; (6) Saturn, 880,000,000; (7) Uranus, 1,700,000,000; (8) Neptune, 2,700,000,000.

11. How far, then, would it be across the solar system? *Ans.*—Just twice the distance of the planet Neptune from the sun. How much is that? *Ans.*—About 5,400,000,000 miles.

12. How fast can a train of cars travel? *Ans.*—About sixty miles per hour. How long would it take it at that rate to reach the sun? *Ans.*—Dividing 93,000,000 by 60 will give the number of hours; divide that by 24, and you will find the number of days required.

13. How rapidly does sound travel? *Ans.*—About 1,190 feet per second. How long would it take the sound of an explosion in the sun to reach the earth? *Ans.*—Divide 93,000,000 miles, reduced to feet, by 1,190; this will give the number of seconds. Dividing this by 60 will give the number of minutes; dividing again by 60 will give the number of hours, and this divided by 24 will give the number of days. Divide the number of days by 365, and you will find it will take about fourteen years for the sound to reach the earth.

14. How rapidly does light travel? *Ans.*—About 200,000 miles per second. It takes light eight minutes to reach the earth from the sun. How much time would be required for light to cross the solar system?

15. Has God other systems? *Ans.*—A great number of them. G. C., p. 677.

16. What conception does this lesson give you of God's universe?

References.—"Principles of True Science:" See Planets. "Parts of His Ways," section 7, chapter 5. Astronomy, see Solar System and Planets.

Suggestions to Teachers.—This lesson is given that the pupils may obtain some conception of the greatness of God's universe. While it takes but eight minutes for light to come from the sun to us, and about four hours to pass through the entire solar system, it requires fifty years for light to come from Polaris, the north star; seventy years from Arcturus; and even hundreds of years from some of the stars. A train of cars, to travel as fast as light, must pass nearly eight times around the earth (25,000 miles) in one second. Make drawing on the board showing the solar system with the sun in the center, and its retinue of planets and their moons passing around it. The pupils should make drawings also.

LESSON VI.

The Seasons.

1. For what purpose did God make the two great lights? Gen. 1:14.

2. What wonderful signs has God wrought recently in the sun, moon, and stars? *Ans.*—

(1) The darkening of the sun, May 19, 1780.
(2) The moon appeared like blood the night following the darkening of the sun. Matt. 24:29.
(3) A great multitude of stars fell from heaven, November 13, 1833. Rev. 6:12, 13.

3. For what purpose did God give these signs? *Ans.*—To show that the day of God is near at hand.

4. What was to control the seasons from the beginning? Gen. 1:14.

5. How many seasons has the world now? Name them in their order, stating the time each one begins and closes.

6. Have we four seasons all over the earth? How many seasons are there where you live?

7. What seasons have the tropical regions? *Ans.*—A rainy and a dry season. How many seasons do you think the Lord made in the beginning? Why?

8. In what way are the different seasons produced? Why is it winter in the North Frigid Zone when it is summer in the South Frigid Zone? *Ans.*—Because the sun's rays strike more obliquely in the North Frigid than in the South Frigid Zone. How long are the summers in these zones? And the winters?

9. Why does spring come earlier in the southern part of the United States than in the northern part? Why have the tropical regions two seasons, while the temperate regions have four?

10. Why does the sun appear farther south in the winter than in the summer?

11. Do you think there were such extremes of heat and cold before sin entered the earth? P. P., p. 61.

12. What is the length of the day? What measures the time? Were the days of creation of the same length as now? P. P., pp. 111, 112; Sp. G., vol. 3, pp. 90, 91.

13. What is a week? A month? *Ans.*—The true month, called the lunar month, is about twenty-seven days instead of thirty, as given in our calendar.

14. What is a year? *Ans.*—It is the time required for the earth to make one revolution around the sun. How many days are there in a year? In a week? Month? How many years are there in a century?

15. Of what service is this division of time into days, weeks, months, and years? What is the great clock which keeps the time, and by which we can compare our clocks and watches to know if they are keeping correct time? *Ans.*—The sun. Who keeps this great clock wound up?

References.—"Parts of His Ways," section 7, chapter 6. Physical Geography, see Seasons. Astronomy, see Time.

Suggestions to Teachers.—It is very probable that there were only two seasons in the beginning, seed-time and harvest. The temperature

was constant in any one place, but that does not mean that it was the same all over the earth. Undoubtedly it was colder near the poles than at the equator. But whatever the latitude, the temperature remained constant. The seasons are not nearly as constant as formerly, and they are growing less so from year to year. This is because the curse rests so heavily upon the earth on account of man's wickedness. The value of time can be made very clear by referring to the confusion which would arise in the school were it not for the clock in each home, which indicates the time for the pupils to start for school, so that each one will be in his place promptly at nine o'clock. Following this lesson, the teacher can appropriately take up the study of the Phases of the Moon, and Eclipses.

LESSON VII.

The Fixed Stars.

1. What heavenly bodies have we studied so far? *Ans.*—The sun, moon, and planets.

2. What are planets? Name those in the solar system. Give their distances from the sun. The greater their distance the longer the time they require to go around the sun.

3. Have all the planets years of the same length? Which has the shortest year? *Ans.*—Mercury. The longest? *Ans.*—Neptune.

4. Give the length of the years of the different planets. *Ans.*—Mercury, 88 days; Venus, 225 days; Earth, 365 days; Mars, 687 days; Jupiter, about 12 years; Saturn, about 30 years; Uranus, about 84 years; Neptune, about 163 years.

5. Should we live the length of man's life mentioned in the Scriptures (70 years), how old would we be in Mercury's years? Venus'? Mars'? Jupiter's? Uranus'? Neptune's?

6. Do you believe these planets are inhabited? Why?

7. What are the stars called which are not planets? *Ans.*—Fixed stars. Why are they called "fixed stars"? *Ans.*—Because they do not wander about among the other stars, but always remain in the same relative position. For example, the Big Dipper always has the appearance of a dipper; and

hence all the stars composing it keep the same relative positions.

8. What is the sun? *Ans.*—It is a fixed star, but appears so much larger and brighter than others, on account of being so near the earth.

9. What are groups of these fixed stars called? *Ans.*—Constellations.

10. What instrument is useful in studying the stars? *Ans.*—The telescope.

11. Who improvised the first telescope? *Ans.*—Galileo. What did he discover with it? *Ans.*—The four moons of Jupiter.

12. What have astronomers discovered with it since his time? *Ans.*—New planets,—Uranus and Neptune, with their moons,—nebulæ, double stars, comets, asteroids, etc.

13. What does the microscope and the telescope teach us? *Ans.*—That God is infinite in little things and in great things. It teaches us that there are many things which we will not be able to discover with our natural eyes, but which we shall see clearly when we are redeemed and follow the Lamb whithersoever He goeth.

References.—"Principles of True Science:" See Stars. "Parts of His Ways," section 7, chapter 7. Astronomy, see Fixed Stars.

Suggestions to Teachers.—Two dollars will buy a telescope which shows the moons of Jupiter and some of the craters upon the moon. A field or opera-glass will do equally as well, and may be loaned from some one who may be interested in your school. A field-glass will be very useful when you come to the study of birds. A new one can be obtained for $10, and a second-hand instrument for $5.00 or $6.00. It is much better for children to spend their dimes and nickels in something that will give them enlarged views of the wisdom and power of God, than to spend them for candies and nicknacks, which not only are not good, but a positive injury, and which also teach them to be selfish.

LESSON VIII.

The Constellations.

1. What is a constellation of stars? *Ans.*—A group or cluster of stars.

2. Does the Bible speak of the constellations of stars? Isa. 13:10.

3. What does the prophet say of them? *Id.*

4. When shall they cease to give their light on the earth? Verse 9.

5. What constellations are spoken of in the Bible? *Ans.*—

(1) The Pleiades, or Seven Stars, as they are called. This is a beautiful little cluster of stars, which is sometimes called the "Little Dipper." The Lord speaks of this group of stars as having a sweet influence which man can not bind. Astronomers, by their study of the heavens and this text in Job 38:31, believe that the Pleiades is the center of the universe, and that the sweet influence is the power which goes out from this center and holds the myriads of worlds in their places.

(2) Orion. In the same scripture this constellation is spoken of as having hands. This is a beautiful constellation, having three stars in a straight line. This is called the band of Orion.

(3) Mazzaroth, spoken of in Job 38:32. The margin reads, "Twelve Signs." This undoubtedly has reference to the twelve zodiacal constellations which form a belt from east to west across the sky, and which are divided into four divisions of three each, corresponding to the

four seasons, and the three months in each season. You can find the names of these constellations in any almanac.

6. Study a few of the easiest constellations out-of-doors at night. The following are suggested: Big Dipper, Pleiades, Orion, Cassiopeia, Lyra, Leo, Corona, The Swan, Bootes, and Auriga.

7. Find the following bright stars in these constellations: Vega, Arcturus, Capella, Regulus.

8. Learn from the almanac which of the planets are morning and which are evening stars.

9. Have the heavenly bodies ordinances (laws) by which they are controlled? Job 38:33; Ps. 8:3.

10. When David considered the sun, moon, and stars, what influence did it have upon him? Ps. 8:3-5. *Ans.*—It made him more humble.

References.—"Principles of True Science:" See Orion. "Parts of His Ways," section 7, chapter 8. Astronomy, see Constellations.

Suggestions to Teachers.—It is not expected that the pupils will get very much out of the study of the fourth day's work the first time they go over it, but rather to see something of the greatness of God's universe, and thus of God Himself. The band in Orion is called the "Yard-stick," because it is three degrees in length. Two of the stars in the Big Dipper are called the "pointers," because they always point to the north star. They are five degrees apart. In "Early Writings," p. 33, we learn that the New Jerusalem, the metropolis of the new earth, will come down through the open space in Orion.

LESSON IX.

Heavenly Bodies as Symbols.

1. Of what did David learn in his study of the heavens? *Ans.*—

(1) Of God's faithfulness. Ps. 89:2.
(2) Of God's glory. Psalm 19.
(3) Of God's greatness. Ps. 147:3-5.

(4) Of his own nothingness. Ps. 8:3-5.

2. What sang together when God created this world? Job 38:7.

3. Who, in the Scripture, is spoken of as the "Bright and Morning Star"? Rev. 22:16.

4. What does the sun represent in the Scripture? *Ans.*—

(1) The Lord God is a Sun.

(2) Christ is the Sun of Righteousness.

(3) When transfigured, Christ's face did shine as the sun. Matt. 17:1, 2.

(4) Christ's countenance is as when the sun shineth in his strength. Rev. 1:16.

(5) The light of the sun represents the glorious light of the gospel as it shines in the Christian dispensation. Rev. 12:1.

5. What does the moon symbolize? *Ans.*—The pale light of the moon, in contrast with the light of the sun, represents the pale light of the gospel in the Mosaic dispensation, in contrast with its brilliant light in the Christian dispensation. Rev. 12:1; 2 Cor. 3:7-11.

6. What is represented by the stars? *Ans.*—

(1) Twelve stars represent the twelve apostles. Rev. 12:1.

(2) The righteous are to shine as the stars. Dan. 12:3.

7. What wonderful instance is recorded in the Bible, showing God's power in controlling the sun and moon? Joshua 10:12-14.

8. Why does the Lord weave into the Bible natural things to represent spiritual truth? *Ans.*—So that when we behold the natural, the spiritual lessons may be recalled to our minds.

9. Was this Christ's method of teaching? Give proof.

10. Should it be our method of presenting truth to others?

Suggestions to Teachers.—This closes the lesson on the Sun, Moon, and Stars, but should not close the study. From time to time go out with the children to view the stars, and learn the names of the planets as they appear during the year. Jupiter and Saturn are splendid planets to observe during the spring, and Mars and Venus during the winter. New constellations are ever coming up in the east. Steele's "Elementary Astronomy" will be a good book for teachers to use in studying the stars.

Chapter VIII.

WATER ANIMALS.

(Scripture Basis, Gen. 1 : 20–23.)

LESSON I.

The First Animals.

1. For what purpose did the Lord create plants?

2. Why did He create the heavenly bodies,—sun, moon, and stars?

3. What did the Lord create on the fifth day? *Ans.*—Animals. Gen. 1 : 20-23.

4. How did He create them? *Ans.*—By His word. *Id.*

5. What brought forth the water animals which were created on the fifth day? *Ans.*—The waters. *Id.*

6. What classes of animals were created on the fifth day? *Ans.*—Water animals and air animals. *Id.*

7. Where were to be the homes of these two classes of animals. *Ans.*—In the air and in the water. *Id.*

8. Name some of the animals which God created to live in the water. *Id.*

9. Did God design that the waters should be inhabited by many animals or by a few only? *Id.*

10. Name some of the water animals with which you are acquainted.

11. What places has the Lord provided in which the animals may live? *Ans.*—Air, dry land, and water.

12. What are the differences between plants and animals?

13. Why did the Lord create the plants before He created the animals?

14. For what purpose were the animals created? P. P., p. 45.

References.—"Principles of True Science:" See Animals. "Parts of His Ways," section 8, chapter 1.

Suggestions to Teachers.—The animals first created by the Lord were the water animals. The waters, through the word of God, brought them forth abundantly. The animals should be studied in their natural conditions as far as possible. The child needs no further classification than is brought out in the first chapter of Genesis,—water animals, air animals, land animals, and man. The first two lessons in this chapter, also the first two lessons in chapter 9, should be studied before the birds begin to return in the spring. After that has been done, devote two days each week thereafter to the study of the different phases of animal life as they develop. Study science in its season.

LESSON II.

How Water Animals Move and Breathe.

1. What is the most common animal that lives in the water? *Ans.*—The fish.

2. Can they live and move about if they are not in the water?

3. Are there animals which can live both on the land and in the water? Name some of them.

4. What do plants need in order to live?

5. What do animals need in order to live? *Ans.*—Light, heat, air, water, and food.

6. Should a man, dog, cat, or horse be placed beneath the water indefinitely, what would happen? Why? *Ans.*—Because they would be deprived of the air they need.

7. When a fish is taken out of the water, what is the result? Why? *Ans.*—Because it is deprived of the water it needs.

8. Can a man, dog, cat, etc., live without water? Can fish live without air?

9. Why do we change the water in an aquarium every day or two?

10. What relation does air sustain to the water animals? *Ans.*—They must have air, but water contains a sufficient quantity to sustain life.

11. By what means do they take the air from the water? *Ans.*—Through their gills. As the water passes through the gills, the oxygen of the air is taken up by them.

12. By what organs in man and other animals which do not live in the water, is the oxygen taken from the air? *Ans.* —The lungs.

13. How do the water animals move about in the water? *Ans.*—By the use of fins, tail, or other organs especially adapted to movement in the water.

14. Does the Lord care for the animals which live in the sea? Ps. 104:25-30.

References.—"Parts of His Ways," section 8, chapter 2.

Suggestions to Teachers.—The Creator, on the fifth day, created a class of animals which could not live unless they were in the water. We find some animals at the present time which can not remain in the water, but have to come to the surface from time to time to get air. The frog, toad, snake, turtle, etc., are familiar examples of this class. They are called amphibians, which means *two lives*—one on the land and the other in the water. The remainder of this chapter will treat of a few of the common water animals, beginning with the simplest forms.

LESSON III.

The Simplest of Animal Organisms.

THE AMOEBA.

The animal kingdom, as well as the vegetable kingdom, is a series of living organisms, presenting all grades of complexity. As we take up the study of these creatures, beginning with the simplest and extending to the most complex, it is with no

thought that the more complex animals have evolved from the simpler forms.

The Creator made each animal for a certain purpose, and gave it a definite place in the scale of beings. They were perfect in the beginning, and did not need a series of changes to make them more perfect.

If you gather some stems of the water-lily, or the stems of some other aquatic plant, and put them into a jar of water for a few days, you will find, upon examination with a compound microscope of the scum which rises to the top, that there are myriads of little living organisms in every drop of water.

The simplest form which you will find is the naked *amoeba* (proteus). You will have to look carefully to see one, for they are nearly as transparent as the water. If you shade the light a little with your hand, you will be better able to see it. When you find it you will see a drop of jelly-like substance, somewhat granular in appearance, with a dark spot in the center, called the nucleus. When first seen, it may be almost any shape; but if you watch it closely, you will see it change both form and position. Suppose it is circular; in a few seconds you will see it thrust out little projections, called *pseudopodia* (false feet); these aid it in securing food and in moving about from place to place. The amœba has the power of making a mouth at any point on its body. When it comes near a particle of food, it takes somewhat the shape of a kidney bean, with the little food particle in the indentation. Then soon it completely surrounds its meal and takes it into the body, something as a drop of the white of an egg would flow around a grain of wheat. It uses that portion of the food which it needs to sustain life, and throws the remainder off at some other part of the body.

Very often you will find the little animal in the shape of a dumb-bell, and the strip of jelly connecting the two balls will continually grow smaller until it completely divides, and the

two balls form separate animals. The nucleus divides, also, and so each new animal will have a dark spot in the center; this spot is the center of the life of the animal, and really comprises all of its vital organs.

Amœbæ are not all like this specimen. Some build for themselves little coverings of fine sand, and take the shape of kettles, vases, etc., while others have a rather tough skin, and are disc-shaped. These all thrust out little feet, or pseudopodia, from beneath their covering, to aid them in moving about and in securing their food.

If you study these, the simplest of God's animal creation, you will see that they are just as carefully made, with organs adapted to their necessities and surroundings, as are the more complex animals, showing that the Creator is not unmindful of the little things. This should teach us the lesson of faithfulness in little things.

References.—"Parts of His Ways," section 8, chapter 3. Zoology, see Protozoa and Amœba.

Questions and Suggestions.—What is the name of the simplest animal? Where is this animal found? How would you collect specimens? Would you be likely to find more than one amœba in a drop of water? What does this little animal look like? (Break an egg on a plate; the yolk will represent the nucleus and the white the transparent portion of the amœba; this is a very good representation.) Has the amœba true feet? (Pseudopodia means false feet.) Does it walk about? How does it move about? Has the amœba a mouth? How does it eat? Has it a stomach? What does it eat? (It lives mainly on small water plants, but it may often be seen to make a mouth and engulf another amœba of smaller dimensions.) How does the amœba reproduce itself? Is this method of reproduction a rapid one? In the study of these microscopic animals, where you have not access to a compound microscope, you should simply endeavor to make a word picture of what might be seen if you had one. It will take some care on the part of the teacher to arouse an interest in these little animals which can not be seen with the naked eye, but by the aid of the egg, and with drawings, the student may be made to grasp the most important facts. The thought which should be dwelt upon is the infinity of creation and God's care for little things.

LESSON IV.

The Slipper Animals.

THE PARAMECIUM.

In the same drop of water in which you found the amœba you doubtless noticed myriads of little slipper-shaped animals, not moving slowly from place to place, as does the amœba, but darting swiftly about, jostling its neighbors, and winding its way through the aquatic vegetation with scarcely a pause. This little animal is called the paramecium, and may be found in great numbers in every pool or jar of water in which there is decaying vegetation.

The body substance of the animal is much the same as that of the amœba, but the shape and general structure are quite different. Its quick motion is made by numerous little cilia, or hairs, which cover its body and have a wave-like motion which propels it about. This animal, unlike the amœba, has a definite mouth. When a particle of food comes near, it is taken into the mouth by aid of the little cilia, and thence through the œsophagus into the body, where it forms a food-ball. These food-balls appear as spots, usually green or brown, in the body substance of the animal. When the nutriment has been withdrawn from the food, the residue is cast out at some fixed place on the body, but there is no permanent opening. It must break through the body wall afresh each time.

The paramecium has not only one nucleus, as has the amœba, but it has two, one large bean-shaped center, and a small circular one near it. At each end of the animal you will notice little circular markings somewhat resembling air bubbles. If you watch them carefully you will see them take the shape of a star, contract, and then resume their former shape. These

are what are called contractile vacuoles, and may be regarded as the simplest form of excretory organs.

The slipper animal also reproduces by division.

It takes the form of a figure 8, then divides transversely, the nucleus dividing with it.

This animal has many relatives in our ponds and pools, and all have either many cilia or single hair-like lashes with which they move about, and which help them in securing food. The green scum common on stagnant pools is a close relative; it is composed of millions of little animals with a single lash. These little creatures multiply so rapidly that the surface of a pond may be completely covered in a short time.

You doubtless wonder how large these little animals are. It will give you some idea of their size when I say that several may occupy a space no larger than the head of a pin, and hundreds may be counted in a single drop of water. These little animals are quite common in our drinking water; they are perfectly harmless, and serve the purpose of purifying the water by destroying the decaying vegetation.

References.—"Parts of His Ways," section 8, chapter 4. Zoology, see Infusoria and Paramecium.

Questions and Suggestions.—What is the shape of the animal about which we studied to-day? Does it move about like the amœba? What organs has this animal which aid it in swimming about? Has it a definite mouth? Where is it located? (In the side of the body.) What does it eat? How does it get rid of the waste which is not used in the body? Has it a nucleus? What and where are the contractile vacuoles? What shape do they take just before they contract? How does this animal reproduce itself? How large are these animals? Has the paramecium any relatives? Name one of the most common. (*Green euglena.*)

LESSON V.

The Bell Animals.

Everything in nature presents a picture of order, symmetry, and beauty, but some natural objects are more beautiful than others; so with these little water animals, some seem more

beautiful than their fellows. One of the prettiest little animals is the bell animal, or vorticella. It, like the amœba and the paramecium, is very simple in structure, being composed of but a single cell. The body is bell-shaped or conical; attached to its apex is a long slender stalk, and when this stalk is extended to full length, the little animal looks somewhat like a plant. But this stalk does not remain extended; it has the power of contracting and drawing the bell-shaped body down to the point of attachment. This animal also is provided with cilia. They form a row around the rim of the bell, and keep up a continual wave motion, thus aiding the animal in the capture of its food by producing a powerful current centering in the mouth. The bell animal also has two nuclei, one long and slender, the other small and circular. You will also notice that the food vacuoles enter the body by a definite mouth. But, unlike the paramecium, this creature has but one contractile vacuole.

The vorticella also multiplies by division, and presents a very interesting study at such times. The body divides vertically, but the stalk does not divide; so you see that at the completion of the division, there are two bells on one stalk. These remain thus for a time, but finally one breaks off, folds in the rim of its bell, acquires a belt of cilia around its middle portion, and swims around for a while. Then it produces a stalk of its own, and attaches itself, after which it loses its belt of cilia and takes the form of the first little animal.

Paramecium and vorticella are herbivorous forms, feeding upon minute plants, and especially upon bacteria. Other forms are omnivorous, feeding both on vegetable and animal food; while still others are carnivorous, and lead a predatory life, often attacking carnivorous forms much larger than themselves.

The bell animal is not so common as the paramecium, but it can usually be found after a short search. One of its closest

relatives is the stentor, which has somewhat the same form, but is more slender and trumpet-shaped. It is carnivorous in habit, and not as common as the vorticella.

References.—"Parts of His Ways," section 8, chapter 5. Zoology, see Vorticella and Stentor.

Questions and Suggestions.—Is there any disorder or confusion in God's creation? What is the shape of the beautiful little animal about which we study to-day? What is it called? Is it in any respect like those we have previously studied? What flower have we which the animal resembles? Does it always remain extended at full length? What causes it to contract? (Various things, often a paramecium striking it, or a sudden jar.) Has this animal any cilia? Where are they located? What is their use? Has the animal a nucleus? How many? Has it a mouth? How does it multiply? Describe how it looks after the body divides. Does the stock divide? Does the bell animal ever swim about? If so, when? Are these little water animals vegetarians? Is the bell animal common? What is the name of one of its close relatives?

LESSON VI.

The Limestone Builders.

THE RHIZOPODS.

The little animals about which we have been studying have no hard outer covering or shell. All microscopic animals are not alike in this respect. Every lake, river, and sea is filled with myriads of tiny creatures possessing a calcareous covering. The body substance of these little animals closely resembles that of the amœba; in fact, the amœba is a close relative, and in many respects they are much alike.

These animals, taken as a class, are called rhizopods (*rhizo,* root; *poda,* foot), from the root-like appearance of their pseudopodia. Many of them are exceedingly beautiful; their shells take various forms, and the study of them affords many pleasant hours to the naturalist.

Although most of them are microscopic, some may be seen with the unaided eye, and many can be studied very nicely with a hand lens. As I have said, these little animals abound

in all bodies of water, both salt and fresh. Some may be found in the same water with the slipper and the bell animals, but they are most abundant in the open sea. If you examine a handful of sand taken from the edge of the water on some seacoast, it will doubtless contain a number of different specimens.

We are very liable to consider these simple creatures as insignificant, and think they count for but little in God's creation. True, each individual animal is but a speck, and would claim the attention of only the student of natural history, but when millions upon millions of these minute organisms go on multiplying and dying, there must be some result which would catch the eye of but a casual observer. Let us see if these, the simplest and smallest of God's creatures, are as insignificant as they at first appear to be.

It is known that the bottom of the ocean between Europe and North America is covered with a light-colored ooze. When this is examined, it is found to be made up of the shells of these very same rhizopods. The sea is full of them, and they are continually dying and sinking to the bottom, their shells, in the course of years, forming a coating of lime on the bottom of the ocean.

The vast quarries of limestone are but the remains of these little animals. The stone is quarried, burned in a kiln, made into cement or plaster, and this is used to cement the brick and stone of our great buildings, to plaster the walls of our houses, or in other ways in the mechanical arts. Man would be at a loss to know what to do without limestone, yet it is but the remains of animals so small that it takes more than the unaided human eye to see them.

Limestone sometimes crystallizes and forms our monument marble, of which our magnificent monuments and statuary in the cemeteries throughout the world are constructed. Much of the earth's crust is composed of chalk, which comes from

the same origin as the limestone. So we see that with all their minuteness these minute animals are of far greater importance than many of the larger and more complex ones.

References.—"Parts of His Ways," section 8, chapter 6. Zoology, see Radiolaria, Foramenifera, and Rhizopoda.

Questions and Suggestions.—Have the animals about which we first studied any covering or shell? Are all of the microscopic animals the same in this respect? What is the name given to some of those having a limy covering? What does rhizopod mean? Are these animals too small to be seen with the naked eye? How common are they? Do they live in both fresh and salt water? Where are they most abundant? Are they as insignificant as they at first appear? Of what importance are they? How are cement and plaster made? What is monument marble? Of what is chalk composed? The thought to impress in this lesson is the infinity of creation, and that the wise Creator provides for the necessities of man in even making the bodies of the minutest animals useful to him. Little things are not to be despised; for God selects the little things to make the mighty. Grains of sand make the earth, and drops of water form the sea. The pennies make the dollars, and our little sins are our worst enemies. If we take care of the little things, the great things will care for themselves.

LESSON VII.

The Stationary Animals.

THE SPONGE.

Many of these simple animals closely resemble plants, and for a long time they were regarded as such by naturalists. About the only positive proof as to the nature of these animals is obtained by collecting and testing the gas which they give off in the process of growth. We know that animals give off carbon dioxid, but plants give off oxygen, so from this we can determine whether our little organism is plant or animal.

One of the animals which was a source of dispute for a long time, is the sponge. It is now generally regarded as an animal. Our common bath sponge is but the fleshy portions of the animal we are about to study. If you examine a sponge

you will see that it is filled with holes of all sizes. During life, the little canals leading from these holes to the interior are lined with little cells which are very much like the amœba. They possess nuclei, and thrust out pseudopodia to aid them in securing their food, and also are provided with little lashes similar to the green euglena. These lashes set up a current, which continually flows through the system of canals which penetrate the colony in all directions, and carries with it the food for the cells. Each one of these little cells leads an independent life, yet it is closely related to the entire colony, and all taken together form the body. You see, therefore, that we have really left the single-celled animals, and have taken up those whose bodies are composed of many cells. In this respect the sponge resembles our bodies and those of all the higher animals.

The water is taken in at the holes at the side, and flows out at the large ones, which you will notice on opposite sides. The sponge colony has been likened to a submerged city, where the people are arranged along the streets in such a way that each may choose his food from the water as it passes by.

Sponges are quite common in both tropical and temperate climates, and may be found in fresh as well as in salt water, but the varieties useful to commerce are nearly all found in warm waters. There are three kinds, known as horny, calcareous (limy), and glassy sponges. Our common sponge is of the horny variety.

Sponges are obtained for market in different ways. The finest and largest are usually obtained by divers, who cut them carefully from the rocks to which they are attached. The smaller and cheaper ones are simply torn loose by long rakes or tongs. After they are obtained they are washed, to free the skeleton from the jelly-like cells, and then are cured and prepared for market. The mineral matter contained in them is dissolved by soaking them in some acid.

References.—"Parts of His Ways," section 8, chapter 7. Zoology, see Porifera and Sponge.

Questions and Suggestions.—Do all simple animals differ greatly from simple plants? How may we distinguish them? What little animal was for a long time regarded as a plant? When the sponge was alive did it look like the one you have? (It resembled a ball of jelly supported on a flexible skeleton.) Is the sponge all one animal? Do the separate cells live independent lives? Are they interested in each other? What new class of animals does the sponge introduce to us? To what might we liken the sponge? Where do sponges live? Where are those used in commerce found? How are they obtained? How prepared for market? In this lesson the thought of unity may well be brought out. The church being the body, each member may resemble a cell, and although each lives an independent life, every one should be interested in his neighbor and seek to build up the body.

LESSON VIII.

The Glove Animals.

THE FRESH-WATER HYDRA.

The hydra is a common little animal in all of our stagnant pools. If you collect some stems of aquatic plants and put them into a jar very likely you will find a number of these animals clinging to the stems, or perhaps to the sides of the vessel.

The hydra is very often large enough to be seen with the unaided eye, and the largest ones can be studied quite well with a good hand lens.

When uncontracted, the body of the hydra is in the form of a cylindrical tube, at the base of which is a sucker by means of which the animal can attach itself to any foreign body at will. Its favorite position seems to be head downward, suspended from the stem of some water plant. It is not, however, permanently fixed, but can detach itself and change its place at will. At the opposite end of the body is the mouth, surrounded by a circle of from five to fifteen small tubular filaments, which are termed the "tentacles." Each tentacle is a little tube open-

ing at its base into the body cavity. These exhibit the most extraordinary contractility, being capable of contraction until they are nothing more than little warts.

The whole external surface of the hydra, and especially the surface of the tentacles, is provided with little cells which have the power of throwing out tiny threads or lashes. These lashes are not like the cilia of which we have studied; they are provided with a sort of poison, or something which has the effect of stinging other small water animals that come near. With the aid of these cells the hydra stings its prey, then seizes it with its tentacles, and crowds it into its mouth, from which it enters directly into the body cavity and stomach, which are one. After the food is digested, the waste is expelled through the mouth.

Reproduction in the hydra is effected both by ova and by sperm cells and also by budding. In the latter process the hydra throws out one or more buds near the fixed extremity. These soon produce tentacles and a mouth of their own, and in a short time they break loose from the parent, to lead an independent life.

An interesting fact concerning this animal, and one which shows its low place in the scale of animal life, is that it can be cut into very small pieces and yet not be killed; in fact, each little particle will produce a new complete hydra.

References.—"Parts of His Ways," section 8, chapter 8. Zoology, see Coelenterata, Hydrozoa, and Hydra.

Questions and Suggestions.—What animal is the lesson about? Is it a common animal? How and where would you obtain it? How large is it? Can you see it without a lens? What is the shape of its body? What is its favorite position? What organ has it at the base end? Does it remain permanently fixed? What are at the opposite end of the body? What are the tentacles? What is their use? What is peculiar about the outer covering of the hydra? How does it secure its food? How does it multiply? What fact shows it to be low in the animal kingdom?

LESSON IX.

The Island Builders.

THE CORALS.

It may seem strange to have a lesson on the study of animals entitled "The Island Builders," but in this lesson we shall describe some small sea animals which, by their faithful and industrious labor, build the islands in the sea. These little animals are called coral polyps. Not very many years ago, coral necklaces were very fashionable for women, but in later years, men have invented something which is a perfect imitation of coral, and, therefore, largely takes its place. The imitation is called celluloid. It is produced by melting cotton in certain chemicals, and pressing it into bars or thin sheets. These sheets of celluloid are then colored to suit the taste. We now possess many useful articles which are made from celluloid, such as knife-handles, paper-cutters, and picture frames. For a long time the most learned scientists believed coral to be a plant.

You remember that in our lesson on the sponge we learned that it was for a long time regarded as a plant, but is now known to be an animal. Coral, strictly speaking, is neither a plant nor an animal, as we find it in ornamental use. But coral as we find it in the sea, in its living condition, is an animal. That which is used for ornamental purposes is the skeleton of the animal. If you examine a piece of coral with a magnifying glass, you will find that it contains many little holes. In each of these small holes lived a soft, jelly-like coral polyp, which possessed arms or tentacles something like the fresh-water hydra. These arms are thrust out of the small opening when seeking food, but when at rest, the arms are withdrawn. Strange to say, the little coral polyp has its skeleton outside the body instead of inside.

There are many different kinds of coral, and some of them distinctly resemble flowers in their appearance. The petals or leaves of the flower, however, are the feelers or tentacles of the animal. These tentacles are called feet by some writers, and that is the reason the animal was named polyp, which means "many footed." Some of the polyps are produced from eggs. When these little creatures die, their skeletons form the foundation upon which another generation builds its homes. Consequently, the great coral rock or skeleton rises higher and higher with each generation, until it reaches the surface of the water. The coral can not live above water; therefore they cease building upward as soon as they have reached the surface. Now, should the water lower in the sea or ocean, this great coral structure would stand above it, and become a coral island; or if by some internal convulsion of the earth the coral should be thrown above the surface, there would still be a coral island.

Many of the islands of the sea are built entirely by these industrious animals, and become the habitation, not only of the lower animals, but of man himself. It sometimes happens that these islands sink into the sea, even after they have been inhabited for years. The coral animals, as we learn from this short description, although very small, do a great work, even to that of providing a home for man, whom God appointed as ruler over the earth.

References.—"Parts of His Ways," section 8, chapter 9. Zoology, see Actinozoa, Corals, and Coral Islands.

Questions and Suggestions.—What is the name of the little animals which build islands? What use was made of coral in years past? In ancient times was coral considered valuable for ornamental purposes, along with pearls and rubies? Job 28:18. Why is coral not used at the present time as an ornament? How is the substitute, celluloid, prepared? What useful articles are made from it? For a long time what was coral thought to be? What other animal was thought to be a plant? The coral used for ornamentation is what part of the real animal? Describe the living coral polyp. In what way does it resemble the fresh-water hydra? In what ways does it resemble leaves and flowers? Why is the coral called a polyp? In

what way do these little creatures build islands? What causes the coral structure to rise above the surface of the water? What may cause it to sink? For whom do these islands provide a home? Will God's truth be carried to the people who live far out on the islands of the sea? Isa. 42:4.

LESSON X.

The Star-Shaped Animals.

THE STARFISH.

In your study of the water animals so far, you have found many creatures having queer shape and structure. Now we come to the study of an animal which looks like a star, and therefore is called by scientists the "starfish." It is a rather ugly-looking object, its entire body being covered with short, stiff spines. The body has five ray-like arms. At the end of each arm is a red spot supposed to be an eye. If this be true, the starfish has five eyes. Underneath each ray is a groove which extends to the central portion of the body, where the mouth is located. These grooves contain hundreds of feet, which the starfish uses in traveling about.

There are many species of starfish, which differ in size, color, and shape. They have a large number of relatives, which live with them in the sea. Some of the most common of these relatives are the sea-urchin and the sea-cucumber. The starfish uses its five rays or arms in capturing its food. It is a bitter enemy of the oyster. Several years ago, men who were engaged in the oyster trade used to gather the starfish with tongs and dredges, and, after breaking them up, would throw them back into the sea, thus hoping to get rid of the oyster destroyers. But in spite of all they did in this direction, the starfish seemed to increase, and the oysters to decrease, and finally, after careful study and observation, they learned that each piece of the starfish developed into a new animal; so,

instead of destroying these mischievous creatures, they were only multiplying them.

The starfish creeps cautiously up to an oyster when its valves are open and its body is fully extended, and places one or more of its rays between the valves to prevent them from closing. Then it sucks the soft, fleshy portion of the oyster into its mouth. Thus you see that not only human beings eat oysters, but starfish as well seem to think them excellent food. But a close study of the oyster reveals the fact that it is a scavenger, occupying about the same place in the water as does the hog on the land. It seems to be its business to clean up all dead and decaying matter which it finds lying about.

The starfish's body is mainly composed of limestone, and when the animal dies its skeleton goes to the bottom of the sea, along with those of myriads of other animals which secrete a similar bony structure. The difference between the skeleton of these creatures which live in the water and those which live on the land is that the former have the skeleton on the outside, while the latter have theirs on the inside of the body. The starfish is a salt-water resident, and is not found in our lakes and streams.

References.—"Parts of His Ways," section 8, chapter 10. Zoology, see Asteroidea and Starfish.

Questions and Suggestions.—What is the name of the creature which is the subject of this lesson? Why is it so called? Mention some of the shapes of the water animals previously studied. What is the general appearance of the starfish? How many rays, or arms, has the body of the starfish? What is the red spot at the end of each ray supposed to be? Does the starfish have any feet? Where are they located? In what respect do the many species of the starfish differ? Name some of the near relatives of the starfish. What use does the starfish make of the five rays? Of what animal is it a bitter enemy? What precautions were once taken to save the oysters from destruction by the starfish? How did it succeed? Describe the manner in which the starfish captures the oyster. Is the oyster eaten by other creatures besides the starfish? What is the business of the oyster? What land animal can you mention which is engaged in the same business? What becomes of the skeleton of the starfish? What other animals have been mentioned which have their skeleton on the outside of the body? Where is the home of the starfish?

LESSON XI.

The Soil Stirrers.

THE EARTHWORM.

In this lesson we are still studying water animals, because the earthworm, while it does not live in the water, lives in the moist, damp earth, therefore we study it in connection with the water animals. Earthworms are the great soil stirrers, and are very beneficial to the farmer in mixing and stirring the soil. The earthworm has several familiar names, such as the angleworm, fish-worm, etc. It is not a beautiful object, but certainly ought to be appreciated for the great good it does. You will have no difficulty in procuring one of them for study. They are especially fond of living in rich, black soil,—the soil which is usually chosen to raise the garden produce. You should obtain one or more of these worms, and study its body, noting how well it is adapted to its manner of living. The more moist the soil, the larger the worm grows. Many of them attain a length of eight or ten inches, and are about as large as a man's little finger.

Count the ring-like segments of the body of an earthworm, and you will find that they number considerably more than one hundred. The body is not exactly round, but is somewhat rectangular in shape, being flattened on the bottom and sides, and rounded on top. How does the earthworm travel? Has it feet? If you think it has no feet, examine the under side of its body carefully with the microscope and you will see that it has multitudes of them. You can also demonstrate this by drawing the animal backward across the fingers. The feet are arranged in double rows; two of these are located on the under side of the worm and one on each side, making four double rows in all. Each ring, or segment, of the worm has eight

feet. How many feet would an angleworm have which has one hundred and fifty segments?

This creature burrows in the soil by eating its way through it. Its body is well constructed for this purpose. If you wish to observe the habits of the angleworm, study it at night, for it is then that it comes out upon the surface of the ground. You will find them, also, just after a rain, crawling about on the surface. Many have supposed from this that the angleworms come down with the rain, but this is not true.

The earthworm is a representative of the worm family, most of whom live in the water. A few, such as the tapeworm and trichina, are parasitic, and live in the bodies of warm-blooded animals. The horsehair worm, the leach (commonly called blood-sucker), and the rotifer, or wheel-worm, all live in the water. Most of the animals called worms are not worms, but are the larvæ of insects, which usually develop into flies, butterflies, and moths. So you learn that we very seldom see a real worm; the most common one is described in this lesson.

References.—"Parts of His Ways," section 8, chapter 11. Zoology, see Vermes and Earthworm, and the other worms mentioned in this lesson.

Questions and Suggestions.—Where does the earthworm live? In what way is it of service to man? What are some of the common names by which it is called? In what kind of soil do they prefer to live? In what respect does the earthworm differ from the animals already studied? What can you say of the size of the earthworm? What is its color? How many segments has its body? How does the earthworm travel? Describe the feet, and their position on the body. How does it compare with the thousand-legged worm as regards the number of feet? How many feet has each segment? Make a drawing of one segment, showing the location of the feet. How is the worm enabled to burrow in the soil? What time is most favorable for the study of the habits of the angleworm? Of what family is the earthworm a representative? Where do most worms make their home? What exceptions have we to this? In what kind of animals do the trichina and tapeworm live? Are the creatures studied in this lesson the ones referred to when we commonly speak of worms? What creatures are referred to? Into what do they develop? What mention is made of worms in the Scriptures?

LESSON XII.

The Shell Animals.

THE SNAIL.

"Slow as a snail," is an expression we often hear applied to people who are slow and lazy; but we shall find that this little creature moves quite rapidly when we come to consider how poorly it is provided with means of locomotion. It has no legs, and but a single foot, and that consists of the part of the body which is protruded from the shell, and by means of this it moves itself about. When we remember that this animal carries its house with it, on its back, it ought not to be slandered for its lack of speed.

The snail is a well-known representative of a very large family of animals, called mollusca, which means soft-bodied creatures. The snail is much more highly developed than are many of its near relatives,—the oyster, clam, mussel, etc.,—for it possesses a head, while the others do not; it is provided, also, with feelers, ears, and eyes. The snail has a real mouth and hard jaws; also a long, ribbon-like tongue, which is covered with teeth, and which works against the upper jaw, thus masticating the weeds upon which it feeds. The common land snail has a spiral shell, whose spire is very short, and whose body whorl is very large, while the pond snail also has a spiral shell, which is conical in shape. The pond snail has but two feelers, while the land snail has four. The eyes of the pond snail are at the base of its feelers, while those of the land snail are at the upper end of the two higher feelers, or horns.

The oyster, clam, etc., are water-breathing animals, while the snail is air breathing. This animal has a little sac which answers for lungs. The pond snail, after remaining in the water for a time, comes to the surface and sets free the bubble of air which it has used, and takes in a fresh supply before descend-

ing again. Snails have a period in which they remain in a torpid condition. During this time they remain in the shell, with the mouth tightly closed with a sticky fluid, which hardens by exposure. They remain in this condition during cold weather; also during exceedingly hot weather.

Besides the clam and the oyster mentioned above, the snail family includes the nautilus, the cuttle-fish—which furnishes the cuttle-bone used in bird-cages—and the octopus, sometimes called the devil-fish. These latter creatures attain an enormous size. If you examine a collection of shells which have been gathered from the ocean, you will find some very beautiful specimens, as regards shape and color. The Creator has made these beings very beautiful, as well as the flowers, which grow where they may be more readily seen by the eye of man. David speaks of this when he says, "They that go down into the sea in ships, that do business in great waters; these see the works of the Lord, and His wonders in the deep." Ps. 107:23, 24.

References.—"Parts of His Ways," section 8, chapter 12. Zoology, see Mollusca, Snail, Clam, and Oyster.

Questions and Suggestions.—To what animal are lazy people often compared? Describe this creature. Does it deserve the reputation given it? In what way does the snail resemble the mud-turtle? Of what family is it a representative? Name some of the near relatives of the snail. How does it compare with them in structure and organization? What does the snail possess which the oyster and clam have not? Describe its mouth, tongue, and teeth. What is the shape of the shell of the common land snail? Of the pond snail? How many feelers has the land snail? The pond snail? Where are the eyes located in these creatures? What kind of breathers are snails, oysters, and clams? What has the pond snail which serves for lungs? How are they operated? At what period are snails inactive? What other members are included in the mollusca family besides the oyster and the clam? How do they compare in size with the oyster, clam, and snail? What lessons may we learn from the examination of a collection of sea-shells? What does David say about the works of God in the sea?

LESSON XIII.

Crusty Creatures.

THE CRAWFISH.

Most of you will need no introduction to the crawfish, which is a common representative of the crustacean family. The members of this family are called crustaceans because their entire body is covered by a hard shell. You will have some difficulty in finding the crawfish; should you not perceive it swimming about in the water, you will readily discover it by overturning some stone or stick which makes for it a hiding-place. The body of a crawfish is divided into three main parts: the head, thorax (chest), and abdomen (stomach). Attached to the thorax are sixteen legs; the first three pairs are very small, and are used mostly in breaking up and chewing the food. For this reason they are sometimes called foot-jaws. The next pair are the great claws, which are so freely brandished when the crawfish is disturbed. If you notice carefully, you will see that these two great claws are not exactly alike; the more awkward one has coarse teeth, and is used to anchor the creature, while the other has fine teeth, and is used for catching and crushing its prey. Just back of the two great claws are four pairs of walking legs. Next is the abdomen, with six pairs of smaller legs, called swimmerets. These are used as paddles for swimming. Back of the swimmerets is the last joint of the body, sometimes called the tail-fin. It is capable of a backward and forward movement, which propels the animal in either direction at its will.

The crawfish has a well-developed head, which projects forward, forming a beak. From the sides of the head extend outward two whip-like feelers, by means of which it examines the objects it meets. It has also well-developed eyes; they

stand out on the ends of two rods, or stalks, one on each side of the head. These stalks can be moved forward and backward, as well as sidewise, so that it can see in all directions without turning its head.

Crawfish breathe by means of gills, which are located on the sides of the body, just underneath the sac-like carapace which nearly envelops the entire body. These gills are hair-like tufts, easily found at the point where the legs join the body. The young of the crawfish are developed from eggs which are laid in the spring; they adhere to the swimmerets, and, after hatching, the young cling to the swimming legs of their mother until they are one-third of an inch long. At this stage they have bright blue eyes, and a pair of small feet. They move about in the water in a very lively way. In three months they are full grown, and begin the battle of life in earnest. In process of growth, the hard outer covering becomes too small, hence they shed their coats five or six times during the first year, a larger coat coming with each change.

The crawfish lives on dead fish and other animal matter which it finds on the bottom of muddy creeks and ponds. By this short description you will see that the crawfish is well fitted to obtain food and to fight its enemies. The crawfish has many relatives which live in both salt and fresh water. The lobster resembles the crawfish very closely, but it is a sea animal.

The crab is another member of this family, and resembles the crawfish, but has been divested of its abdomen, or rear portion of the body, so that it is nearly circular in shape. The crab also lives in salt water. The hermit crab is a curious member of the crustacean family. Its tail is unprotected, so it thrusts it into the shell of some dead mollusk. If it can not find an empty shell, it kills and drags out the inmate, and takes possession until it needs a larger one, when the operation is repeated.

18

References.—"Parts of His Ways," section 8, chapter 13. Zoology, see Arthropoda, Crustacea, Crawfish, Crab, and Lobster.

Questions and Suggestions.—What is the name of the animal considered in this lesson? Of what family is it a representative? How did it secure its family name? Where may the crawfish be found? Into how many parts is the body divided? Name these parts. How many legs has the crawfish? For what are the first three pairs used? Describe the great claws; for what purpose are they used? What are the six pairs of legs on the abdomen called? Where are the swimmerets located? What is the purpose of the tail-fin? Describe the head of the crawfish. Has it eyes? Where are they located? By what means does the crawfish breathe? Where are the gills to be found? Describe their appearance. How are young crawfish produced? Describe them in their early stage of existence. How much time is required to develop into a full-grown animal? What takes place in the hard outer covering as the animal grows during the first year? Upon what does the crawfish live? Name and describe some of the near relatives of the crawfish.

LESSON XIV.

The Fin Family.

THE MINNOWS.

What is more interesting than to watch the little minnows as they swim about in the brook, now and then catching the bread-crumbs which are thrown to them by some kind boy or girl? The fish family, of which the common minnow is a representative, is a very large one, and a very interesting one to study. Secure some minnows from the brook; place them in a clean glass dish, and notice how they use their fins in swimming about.

It seems wonderful that a fish can rise, sink, or remain at rest in the water, when it is so difficult for many animals to keep from sinking; but the fish is adapted to the water, just as truly as a bird is adapted to the air, or as man and many of the lower animals are adapted to the land. The fish has an air bladder which enables it to rise or sink. The fuller the bladder with air, the lighter becomes the body; but the

less air the bladder contains, the heavier the fish. The fish has several fins, located on different portions of the body. On the back is the dorsal fin; and, almost directly below it, is a pair of ventral fins; a little back of the ventral fins is the single anal fin.

On the sides of the body, near the gills, is a pair of pectoral fins. All the fins are used in directing the different movements of the fish. The tail is called the caudal fin. It is used as an oar in moving the body forward. This is done by a side-to-side movement of the tail as a person would use an oar in skulling. The dorsal fin, located on the back, and the anal fin, located on the abdomen, but a little further back, are used to keep the body in a straight line when the fish moves forward.

The pectoral and ventral fins are used to balance the body. Fish also breathe by means of gills instead of lungs. These are arranged on each side of the head; the water enters the mouth, passes over the gills, and then out again. The gills separate the air from the water, which unites with the cold, red blood of the fish, and in this way is carried throughout its entire body.

The difference between fish and land animals in the matter of breathing is this: the former take the air out of the water, while the latter take it from the atmosphere. We all know that fish must have air, for they will not live long, even in water, unless it is well supplied with air.

Water, to be well supplied with air, must be in motion, or must have aquatic plants growing in it. In an aquarium the water should be changed every twenty-four hours. The food of fish consists largely of worms, insects, and smaller fish. Fish increase in number by laying eggs, much as do the birds and reptiles. The fish family is so large that it would take a long time to name all the different species which we find in lakes and streams. Some of the more common ones are the

chub, bass, perch, trout, pickerel, red-horse, bullhead, sucker, etc.

References.—"Principles of True Science:" See Fishes. "Parts of His Ways," section 8, chapter 14. Zoology, see Vertebrata, Pisces, and Minnows, and study such fish as are common in the brooks and streams of your locality.

Questions and Suggestions.—Of what large family is the common minnow a representative? Which is the best way to study and observe the minnow? By what means are fish enabled to rise or sink in the water? For what purpose are fish provided with fins? Name and locate the several fins of the fish: What is the purpose of the dorsal and anal fins? The pectoral and ventral fins? By what means does the fish breathe? Where are the gills located? What must be done with the water in an aquarium in order that the fish in it may live? How often should the water be changed? What other means of providing the water with air may be used? Of what does the fish's food consist? How do they multiply? Name some of the common members of the fish family. What means are used by fishermen to catch fish? Does the Lord control the animals which live in the sea? Does He provide food for them? Ps. 104:25-30. What instances are recorded in the Scriptures which show that God controls the fish? Read the first chapter of Jonah, also Luke 5:1-11, and Matt. 17:24-27.

LESSON XV.

The Frog Family.

THE FROG.

The frog is a four-legged, slippery, slimy creature, which makes its home in low, marshy ground, and small ponds and streams. The frog, unlike the fish, is adapted to living on the land as well as in the water. Frogs are excellent swimmers, and if we desire to become easy and graceful in the exercise of swimming, we would do well to imitate them. Frogs develop from eggs; after the young are hatched, they pass through a series of changes. The tadpole, as the young frog is called, has a large head, a short, thick body, a long, compressed tail, and feeds on vegetable matter which it finds growing in the water. The

eggs, or spawn, as they are sometimes called, are surrounded with a sort of jelly, which fastens them to sticks and plants in or near the water. About a month's time is required to hatch the eggs.

In the tadpole stage, the frogs live in the water, breathing by means of gills which grow out from each side of the head like plumes. After a time the gills disappear, and the animal begins to develop hind legs. Shortly after the hind legs appear, the fore legs begin to develop. As the legs grow, the tail gradually shrinks away, and we have as a result a perfectly-developed young frog, which spends its life in the water and out of the water just as it pleases. The frog is a representative of a large family of animals usually called amphibians. The amphibians may be classified into three divisions: first, tailed amphibians, such as the salamander; second, tailless amphibians, such as the frog and toad; third, footless amphibians, such as the blindworm.

Toads are very much like frogs, but have a thicker and more chunky body, the upper part of which is covered with warts. Toads are most active at night. They live upon the land, except in the spring, when they live in ponds and pools, where they go to lay their eggs. There are many kinds of frogs and toads. Besides the toads which live on the ground, there are those which live in trees, called tree-toads. The toes of their feet are enlarged into discs, so that they are able to sustain their bodies on the branches and trunks of trees. The small cricket-frog is found on plants, near the water, where its shrill, piping song may be heard during the entire night in the summer. The various members of the frog family have long tongues, which are fastened to the front part of the jaw, and are free behind, so that they can roll them out and catch insects, by the aid of the sticky, gum-like substance with which their tongues are covered. Small insects constitute the principal diet of the frog family. During the winter

frogs lie buried in the mud at the bottom of ponds, while toads hide themselves in similar places, or under stones. All have more or less ability in the matter of producing music. The bullfrog sings a double bass. In the spring-time, when the frost is leaving the ground, the frogs make the evenings pleasant with their trilling notes.

References.—"Parts of His Ways," section 8, chapter 15. Zoology, see Batrachia, Amphibia, Frog, Toad, and Salamander.

Questions and Suggestions.—In what respect does a frog differ from a fish? Describe the changes which take place in the development of a frog from the egg to the adult. Where are the eggs deposited? With what are they surrounded? How much time is required to hatch the eggs? Of what family is the common frog a representative? What is the meaning of the word "amphibian"? Into how many classes are the amphibians divided? Name these classes, and give examples of each. What is the difference between a toad and a frog? At what time is the toad most active? In what respect does the tree-toad differ from the ground-toad? Describe the feet of the tree-toad. Describe the small cricket-frogs. Where are they found? Describe the tongue of the frog. What is its chief article of diet? Where do frogs and toads stay during the winter? What can you say of the musical ability of the frog family? What instance is recorded in the Bible showing God's power over frogs? Ex. 8:1-14. Were the magicians also able to bring frogs upon the land of Egypt? By whose power were they enabled to do this?

LESSON XVI.

The Reptile Family.

THE SNAKE.

All persons are familiar with the snake, or serpent, so much dreaded by mankind in general. Doubtless this dread is caused on account of the story which we read in the Scriptures of the serpent that was instrumental in leading our first parents into sin. It seems very probable that the snake was the animal referred to in the Scriptures. On account of the deception which the serpent practised upon our first parents, the Lord said to it, "Thou art cursed above all cattle, and above

every beast of the field; and upon thy belly shalt thou go, and dust shalt thou eat all the days of thy life." Gen. 3: 14, 15.

The snake has no legs, no breast-bone, no eyelids, and no external ears. On account of the absence of eyelids, the eyes of the snake have a fixed and staring look, resembling those of birds. Snakes shed their skin at least once a year. The eggs of the snake resemble those of birds, but the shells are soft and flexible instead of hard. Although the snake has no legs, it is able to travel quite rapidly. It moves by a free movement of the ribs and a general muscular movement of the body. How the snake could move without feet was a puzzle even to the wise man, for he says, "The way of the serpent upon a rock, I know not."

The snake is a representative of a large family of animals called reptiles. As a rule, the bodies of these creatures are covered with scales, as are the feet and legs of a chicken. In many ways reptiles resemble birds; they have the eye of a bird; their eggs resemble those of a bird; but the scales of the bird are more highly developed into what are called feathers.

The lizards and turtles are also members of the reptile family, and are very common animals. The turtle carries its house on its back, hence it is never without house and home. The shell forms a protection to the body, enabling the occupant to resist the attacks of its enemies. The turtle, instead of having no eyelids, has three of these appendages. The eggs of the turtle are soft-shelled, and are deposited in the sand, where they remain until they hatch.

Lizards resemble snakes more than do turtles, being long and slender, but they are provided with four legs adapted to swift running and climbing. One of the lizards—called the swift, because of its alertness in running along fences—lives in and about old, deserted buildings. The horned toad, so called because of its resemblance to our common toad, has its body covered with little spines. This creature lives on the dry,

sandy plains of the west. It is perfectly harmless, and pretends to be dead if in any way interfered with. It has great power of endurance, living weeks, and even months, without partaking of food.

The alligator and crocodile are the largest members of the reptile family. These animals live only in tropical climates, in such waters as the Nile and the Ganges. The snake lives largely upon flesh food, such as frogs, toads, and fish, sometimes attacking even fowls. They swallow their food whole, the work of digestion being carried on entirely without the assistance of mastication. There are many more creatures living in the waters which would be interesting to study, but much of this work must be left for future times. All these creatures are dependent upon God for existence. Read what the psalmist says about God's care for His creatures, and their dependence upon Him. Ps. 104:24-30.

References.—"Principles of True Science:" See Serpents. "Parts of His Ways," section 8, chapter 16. Zoology, see Reptilia, Snake, Crocodile, Alligator, and Mud-turtle.

Questions and Suggestions.—Where do we first learn of the serpent, or snake? How are people disposed toward this creature? What curse did the Lord pronounce upon the serpent? Why? Describe the snake, as to its eyes and skin. How often does it shed its skin? Compare the eggs of the snake with those of the bird. How is the snake able to travel, since it has no feet? What very wise man acknowledged that this was a puzzle even to him? Of what large family is the snake a representative? What higher form of scales cover the body of the bird than those which cover the body of reptiles? Name some of the near relatives of the snake. Describe the turtle, lizard, and horned toad. What are the largest members of the reptile family? Where do they live? Have we, in the Bible, a description of the crocodile? Read Job 41. Of what does the food of the reptiles consist? How do they eat their food? Compare the animals which live in the water—as to number—to those which live on the land. Who looks after this great multitude of animals which live in the sea? Should God hide His face from them, what would be the result?

Chapter IX.

AIR ANIMALS.

(Scripture basis, Gen. 1:20-23.)

LESSON I.

The Creation of Birds.

1. What did the Lord create on the fifth day?

2. Where were these animals to live?

3. What name did Moses give to the creatures which were to live in the air? *Ans.*—He called them fowls.

4. Where were the fowls to fly? *Ans.*—In the open firmament of heaven.

5. In what medium were the whales, fishes, etc., to live and move? *Ans.*—In the water.

6. In what medium were the birds to live and move? *Ans.*—In the air. Gen. 1:26.

7. How are the birds enabled to fly in the open firmament of heaven? See lesson 6, chapter 3.

8. What do the birds use in flying? *Ans.*—Two wings and a tail.

9. What are the leading characteristics of the water animals? *Ans.*—

(1) Their bodies are covered with scales.
(2) They are cold-blooded animals.
(3) They breathe by means of gills.
(4) They multiply by means of eggs.

10. What are some of the leading characteristics of birds? *Ans.*—

(1) The body is covered with feathers.
(2) They are very warm-blooded animals.

(3) They breathe by means of lungs.

(4) They multiply by means of eggs.

11. What purpose do birds serve in God's creation?

12. Has the Lord control over and care for the birds? 1 Kings 17:1-8; Luke 12:24; Matt. 6:26; Ps. 147:9; Job 38:41.

References.—"Principles of True Science:" See Birds. "Parts of His Ways," section 9, chapter 1.

Suggestions to Teachers.—The air animals,—birds,—were created on the fifth day, and so constructed that they were adapted to an aerial life. The birds contribute much to man's happiness by their sweet, melodious songs. They speak to the ear of the wondrous love of God, while the flowers speak to the eye of the same attribute. We should constantly seek to see the wisdom of God in so constructing the creatures He has made that they are adapted to their homes. Do not trouble the mind with classifications which are difficult and hard to remember. In the study of plants and animals, consider them in their natural surroundings, carrying out God's purposes in their creation. We are exhorted to study plants and animals. Matt. 6:28; Job 12:7-10. God gave wisdom to Solomon, and he studied all kinds of plants and animals. He knew more about these things than all the wise men in the nations around him. 1 Kings 4:29-34. God will bless all those who study to His glory and honor.

LESSON II.

How to Study the Birds.

1. When is the best time to study the birds? *Ans.*—In the early spring, when they first begin to appear.

2. How should this line of study be taken up? *Ans.*—

(1) Provide yourself with a good field-glass, which will greatly aid in noting the colors of the plumage of birds. It will be especially helpful in studying those birds which are very shy.

(2) Provide yourself with a good note-book and pencil, in which to record your observations. Tie the pencil to the note-book, so that you will

always be provided with one. Your note-book should be long and narrow, so that it will slip into the vest pocket. Always take your note-book with you, for you do not know at what moment you may see a new bird.

(3) Make your notes accurately, but rewrite them, making them more complete, as soon as you return home.

(4) The best time to make your observations is in the morning at sunrise, and in the evening at sunset. Probably some old orchard will be found a most favorable spot for observation. The favorite haunt of the birds of your community will be learned after observations have been made.

3. What points should the notes on birds cover? *Ans.*—

(1) Their number. You should number the birds in the order you observe them. If the robin is the first bird to appear in the spring, it should be catalogued as No. 1. In this way you will learn in a few seasons' study the order of the birds' return.

(2) The date. Note the date on which you first observe the bird.

(3) The locality where the bird was seen,—in the woods or in the field, on the ground, in the water, or in a tree.

(4) Their flight, whether undulating, sailing, or ordinary flight.

(5) Their nest; the time of building, time required, material, location, etc.

(6) Their eggs; the number, color, size, time required to hatch, etc.

(7) Their food, whether fruit, grain, insects, etc

(8) Their disposition, whether the bird be nervous, quarrelsome, or good-natured.

(9) Their structure. Study the bird as adapted to its environments.

(10) Their departure. If the bird migrates for the winter, give the date of its departure.

4. Study the birds which remain during the winter, and make a list of them. Where do they stay during the winter months? and where do they obtain their food?

5. Who gave to each bird its peculiar habits and mode of living?

References.—"Parts of His Ways," section 9, chapter 2.

Suggestions to Teachers.—This lesson outlines briefly some of the points to be studied in observing birds. The student will not be able to carry out this outline with reference to every bird he sees, but should do so with a few of the more familiar ones, such as the robin, bluebird, bluejay, English sparrow, etc. If students do not know the name of a bird, they should be required to give an accurate description of it before the name is given. The pupils should study the birds throughout the entire bird season. This plan of study will make them constant, careful observers, not only during their school years, but all through life.

LESSON III.

The Parts of a Bird.

1. On what day did God create the birds?

2. What other class of animals were created on the same day?

3. What homes did God provide for these two classes of animals?

4. How are they able to move about in the water and in the air?

5. Describe a typical bird by naming its different parts.

(1) The body of a bird is covered mostly with feathers, the feet and lower part of the legs being covered with scales.

(2) The head supports a bill, which differs in shape in different birds. The bill is adapted to the habits of the bird, some being long and slender, some being short and flat, others short and thick.

(3) The wings of birds vary greatly. Some are small and unable to support the bird in the air. Some are short but wide. Others are very long and somewhat narrow for their length.

(4) The legs of some birds are long, and others very short.

(5) The feet differ very much. Some have long toes, and others short. Some have webbed feet, while others have not.

(6) The tails of some birds are very long, while in others they are very short. Some have slender and others wide tails.

6. Why is there so great difference in the structure of the same parts in different species of birds? *Ans.*—These parts are fitted to the habits of the birds. A humming-bird needs a long bill to draw the nectar from the flowers, and the snipe and crane need them to take their food out of the water. The last two birds need long legs, as it is necessary for them to wade about in the water to find their food. The birds which swim need webbed feet in order to move about rapidly on the water. A hen makes very slow progress in swimming, but it far excels the duck in the matter of scratching,—its method of obtaining much of its food.

7. In order to have a good understanding of the parts of a bird, what must we study? *Ans.*—Its habits. Why?

8. In what way did God show His love for the beautiful in constructing birds? *Ans.*—In their beautifully-colored plumage. Job 39:13.

References.—"Parts of His Ways," section 9, chapter 3. Zoology, see Aves.

Suggestions to Teachers.—Study a few common birds, as to their beaks, feathers, wings, legs, feet, and tail. The following birds are suggested for study: the hen, duck, goose, turkey, peacock, quail, snipe, robin, woodpecker, guinea-hen, and dove. Notice carefully how each part of these birds is so constructed that it best subserves the interests of the bird. These points should be well fastened in the minds of the pupils, for the most of the lessons in this chapter will be studies of the nature and habits of individual birds.

LESSON IV.

Birds' Eggs.

1. In what way are young birds brought into the world? *Ans.*—Through the means of eggs.

2. What animals have we already studied, which produce their young by means of eggs?

3. What difference do you see between the eggs of birds and those of reptiles? *Ans.*—The shells of the eggs of reptiles are soft, while those of birds are hard.

4. Where do reptiles usually lay their eggs? *Ans.*—Usually they lay them in the sand. Sometimes you will find them in the water or even in nests which are crudely built of grass and sticks.

5. Do you know of any bird which lays its eggs in the sand? *Ans.*—The ostrich. Job 39: 13-18.

6. What causes an egg to hatch? *Ans.*—Heat. How are the eggs of reptiles and ostriches protected? *Ans.*—They are buried in the sand.

7. Where do most birds deposit their eggs? *Ans.*—They build nests in which they deposit their eggs.

8. How do they receive the heat necessary to hatch them? *Ans.*—By the parent bird sitting continuously on the nest, heat from her body is imparted to the eggs.

9. Are birds warm-blooded animals? Are reptiles? Do they act wisely in covering their eggs with sand, instead of

with their own bodies? From whence do they receive their wisdom?

10. How long are birds required to sit on their nests before their eggs will hatch? *Ans.*—The time varies with different birds.

11. Give the time required for a hen, turkey, goose, robin, phœbe, English sparrow, and swallow to sit.

12. How many eggs do the above-named birds lay before sitting upon them? Describe their eggs as to size, shape, and color. To what in the vegetable world does the egg in the animal world correspond? *Ans.*—To seed.

13. Break an egg into a saucer, and notice its general structure and appearance.

14. What are the different parts of an egg called? *Ans.*—

(1) The shell. This is the wall of the egg, which protects its delicate structure within, and gives it permanent form.

(2) The white of the egg. This is the clear, transparent portion, which turns white when cooked. It is the albumen of the egg, and by scientists is called protoplasm.

(3) The yolk of the egg. This is the yellow, globular portion, which is surrounded by the protoplasm. It is called the nucleus, and is the portion of the egg which contains the germ of the chicken.

15. Of how many parts does the egg consist? *Ans.*—Three,—the cell-wall, the protoplasm, and the nucleus.

16. Compare the egg, as to its parts, and the purpose of each part, with the bean seed.

References.—"Parts of His Ways," section 9, chapter 4. Zoology, see Birds' Eggs.

Suggestions to Teachers.—This lesson, and the one following, will give the pupils a better idea of what is meant by carrying out the instruction in lesson 2, "How to Study the Birds." In doing this

work, the pupils will be studying as did our first parents. "With every living creature, from the mighty leviathan that playeth among the waters, to the insect mote that floats in the sunbeam, Adam was familiar. He had given to each its name, and he was acquainted with the nature and habits of all." "Christian Education," p. 207; "Patriarchs and Prophets," p. 51.

LESSON V.

Bird's-nests.

1. At what time in the year do the birds return to your community? Where have they been? When did they go away? Why?

2. Did all the birds go away? What ones remained? Where did they stay during the very cold days of winter? What did they eat?

3. How long after the birds return, before they begin building their nests?

4. What materials are used by birds in building their nests? *Ans.*—Leaves, grass, hay, hair, twine, wool, mud, sticks, thread, feathers, etc. Give examples.

5. Where do birds build their nests? *Ans.*—
   (1) In trees. What birds build their nests in trees? Is it a good place?
   (2) In or about buildings. Name birds which make their nests on the inside of buildings. Those which build them on the outside.
   (3) On the ground. Name some birds which build their nests on the ground.
   (4) In the ground. The petrel, an ocean bird, builds its nest underground on islands which are hard to reach by man.
   (5) In low bushes. Name some birds which always build their nests in the bushes.
   (6) On rail fences. What birds?

(7) In hollow stumps. What birds?

6. What birds will build their nests in small houses made for them?

7. Do all birds build their nests alike as regards shape? Give some of the more common forms of nests.

8. Do birds try in any way to hide their nests? In what ways?

9. Do birds occupy the same nest more than one season? Prove your answer.

10. Do birds rear more than one brood each season? Give proof.

11. Is it wrong to take the eggs or the young birds away from their nest? Is it wrong to destroy their nests? Deut. 22:6, 7.

12. Why does David refer to the nests of the sparrow and swallow in Ps. 84:3?

13. Do you think God designed that all birds should build their nests in trees? Ps. 104:12-17.

14. Who lived in this world at one time, and was more homeless, even, than the birds? Matt. 8:20.

References.—"Parts of His Ways," section 9, chapter 5. Zoology, see Bird's-nests.

Suggestions to Teachers.—This lesson, and the two preceding, will give the pupils an opportunity to reveal to the teacher how much they observed the birds. The pupils can tell what they know, and then be urged to be more observing along the lines indicated in the lessons. Many of the questions can be readily answered, while others will require time and careful observation. The teacher should frequently be in the woods and fields observing, so that he can direct the children in their observations to better advantage. See to it that the children are keeping a record of the birds, as indicated in lesson 2. We shall now take up the study of some of the most familiar birds, and learn their habits.

LESSON VI.

The Scratchers.

THE HEN.

The hen is a very familiar fowl to every one, and, being so common, it may be easily studied at any time. No doubt the hen and her companion, the rooster, are as old as man himself, if not a day older. The hen is spoken of in the Scriptures, by Christ, when He desired to express His love and affection for Israel. Even as a hen gathereth her chickens under her wings in the time of danger, so Christ would gladly have shielded Israel from impending calamity, but they would not let Him. Matt. 23:37.

The hen is a land fowl; it may fly or perch, but the ground is its home. It is almost as much out of place in the water as a fish would be on land. The hen has a short, stout beak, with the upper jaw turning its sharp point a little down over the under jaw, which makes a splendid instrument for pecking. What could the hen do with the bill of a duck? The leg is of medium length, and set near the middle of the body, and is suited to running. The foot has four toes. The hind toe is a little higher up than the three front toes, and is long enough to use in perching. The toes are nearly separated instead of being webbed. What could a hen do with a foot like the duck, when she has to scratch to get a living for herself and large family? The wings are strong and somewhat round, instead of being pointed, but they are good for flying short distances.

The hen is a representative of a very large family of fowls, some of which are tame and others are wild. The tame relatives are the turkey, guinea-fowl, and peafowl. They are somewhat different in their ways, but their general structure is the same, and they all do some scratching to get a living; so they go by the name of "The Scratching Family." The hen

and the rooster make life pleasant by their cackling and crowing, the turkey gobbler by its gobbling, the guinea-fowl by its brassy clicking, and the peacock by its doleful crying.

The wild members of the family are the quail, prairie-chicken, partridge, grouse, and sage-hen. The scratchers, both wild and tame, lay from twelve to twenty eggs before sitting. The time required for hatching is three or four weeks. They build their nests on the ground out of dried grass and sticks, often lining them with feathers from their own breasts. Some of them roost on the ground for fear of owls and hawks, while others roost in trees for fear of foxes, rats, and weasels. The tame fowls are much used for food, and their feathers for pillows, mattresses, and cushions.

References.—"Parts of His Ways," section 9, chapter 6. Zoology, see Gallinæ, and birds mentioned in this lesson.

Questions and Suggestions.—How old is the hen? Where is it spoken of in the Bible? By whom? For what purpose? Where is the home of the hen? Describe her bill, wings, legs, feet. For what are the feet adapted? Bill? Legs? Of what value would be the duck's bill and feet to the hen? What large family does the hen represent? Name the tame scratchers. Wild scratchers. Where do the wild scratchers build their nests? Out of what material? Give the number of eggs, the time required for hatching. Where do they roost? Name their enemies. Of what value is this family?

LESSON VII.

The Swimmers.

THE DUCK.

The duck is another domestic fowl, but quite different from the hen, which we studied in the previous lesson. Compare the bill, legs, feet, and wings of the duck with those of the hen, and you will see that there is a great difference. Why?—Because they live a different life. The duck is a water bird, while neither the hen nor her relatives are designed for the water.

Notice how the duck wabbles along. Its feet are located so far back, it is with considerable difficulty that it walks at all. If it attempts to run, it will certainly fall over. Its feet are so constructed that it can not perch, neither can it scratch like a chicken. The three front toes of the duck are joined together by a thin membrane. The foot is webbed, and makes a splendid paddle. Each foot is a paddle, which propels the body easily and rapidly through the water. By examining the body carefully, you will see that it is shaped like the keel of a well-made boat. The duck secretes an oily fluid, with which it oils its feathers, thus keeping the water away from the body.

Notice a hen which has hatched out a brood of ducklings, as they sail on the water. They are so happy, but she is very miserable, because she thinks that they are not more adapted to the water than herself. Watch a race between chickens and ducks when they are called to be fed. The chickens far outstrip the ducks in the race. The feet of the duck are far back on the body, like the paddle-wheel of a steamboat. The food of the duck is found largely in the shallow, muddy bottom of streams and ponds. With its large, flat beak, which is fitted up with plate-like strainers, it retains the food and rejects the mud and water. The wings of the duck are long, and are well adapted to long and continuous flight. The water forms a protection to the duck; for when in danger it may swim rapidly away, or dive and swim beneath the water for some distance.

The duck is only a single representative of a large family of birds, most of which are wild. The goose belongs to the same family. On account of these birds being great water-fowls, and moving about so easily and rapidly in the water, they are spoken of as the "Swimming Family." Besides the duck, goose, and swan, which are domestic fowls, there are many wild swimmers, not only ducks and geese, but others, such as the loon, auk, penguin, pelican, etc. All of these have webbed feet, and are more thoroughly water birds

than are ducks and geese. The last-mentioned birds have their feet still further back than the duck, and can not stand up except in a perpendicular position. The penguin, of the Antarctic seas, has no feathers on its wings, and uses them only in swimming, but never in flying. The swimmers lay several eggs, like the scratchers, but make their nests on the ground near the water. They construct them of dried grass, and line them with soft, downy feathers from their own bodies.

References.—"Parts of His Ways," section 9, chapter 7. Zoology, see Pygopodes, Anseres, and birds mentioned in this lesson.

Questions and Suggestions.—Compare the bill, legs, and feet of the duck with those of the hen. Where is the home of the duck? How do you know? What is the general shape of the duck's body? Where on the body are the legs located? What purpose do the legs and feet serve? How is the bill of service? What is its form and structure? What keeps the duck from becoming water-soaked like the hen? Where does it get its oil?—From oil glands near the tail. What tame relatives has the duck? Wild relatives? What is the family name of these birds? How do the loon and penguin differ from the duck? Of what value are the swimmers? How many eggs do they lay? Where do they build their nests? Of what materials?

LESSON VIII.

The Waders.

THE SNIPE.

The snipe is a rather common bird, which belongs chiefly to North America and Europe. It is found along the shores of ponds and small streams, where it searches for food. It prefers the damp, marshy ground, for into this it can thrust its long, soft bill, which is provided with the sense of feeling. The bill of the snipe feels for a worm as sensitively as if it were a finger. The snipe is a little smaller than the mourning dove, but has much longer legs. It needs these in order to wade out into the water and catch its prey, which consists of small minnows and other small animals.

You observe that the snipe resembles neither the duck nor the hen, for it is neither a land bird nor a water bird, but is about half way between the two. The snipe is a representative of a very large family of birds which have exceedingly long legs adapted to their peculiar mode of life, which is lived along the shores of lakes and streams, and in low, marshy places. The wading birds are not represented among the domestic fowls, but are found wild all over the world. Some of the more common waders are the plover, sandpiper, woodcock, heron, crane, flamingo, and stork.

The flamingo is a very large bird, having a long, snaky neck, the whole body being covered with a beautiful, scarlet plumage. It has a webbed foot like the duck, which enables it to walk with ease on the soft mud. The nest of the flamingo consists of a slight elevation of earth, at the top of which are deposited the eggs. When the female bird is sitting, she folds her legs under her like a carpenter's measuring rule.

No doubt you have seen the large white crane, called the whooping crane, because of the loud, whooping noise which it makes. If you have not seen it, probably you have heard it, for it produces a noise that can be heard several miles. The American coot, commonly called the mud-hen, is an inhabitant of low, marshy ground. The heron and stork are very large members of the wading family.

In Holland, where the stork is most abundant, they are greatly prized by the people; and it is thought that they bring prosperity to the person who is kind to them. They build their nests in cities on the tops of the houses or chimneys. The nest consists of sticks lined with twigs, straw, and dry grass. They lay three or four bluish-white eggs, and it requires thirty days to hatch them. The waders are a very large and very interesting family of birds, and examples of them for study may be found almost everywhere.

References.—"Parts of His Ways," section 9, chapter 8. Zoology, see Grallatores, and birds mentioned in lesson.

Questions and Suggestions.—What is the name of the bird you are studying in this lesson? In what countries is it chiefly found? Where would you go to look for a snipe? What kind of place do they especially prefer? Describe the snipe as to the shape of its bill, and the use which it makes of it. What can you say of its legs? Why are they of such great length? Of what does the snipe's food consist? Compare the snipe with the duck and hen previously studied. Name the relatives of the snipe. What is the one leading characteristic of the wading birds? What is their family name? How do the waders vary in size? Describe the flamingo. Describe its nest. What attitude does the bird take in sitting? What member of the wading family is very noisy? What member of the family is especially prized in Holland? How do they treat this bird? Why? Describe the nest of the stork. Describe the eggs. What time is required for them to hatch? In this lesson, as well as the two preceding, a brief description of the typical bird is given, and the thoughts brought out with reference to it are only suggestive. The teacher should have books to which he may refer and gain additional facts which will be of interest to the pupil. The aim is to select the most common type of each family, those which the students will be most apt to see. After this one has been described, then its near relatives will be mentioned, and a name given to the whole family. We have now considered the hen, which is a type of the scratching family; the duck, of the swimming family; the hawk, of the plundering family; and the snipe, of the wading family. Another year, when the students come to the study of birds, they will become acquainted with some other member or members of each family, thus enlarging yearly their acquaintance with birds.

LESSON IX.

The Plunderers.

THE HAWK.

All are more or less acquainted with the bird called the chicken-hawk. It is so called because it is especially fond of chickens; and for this reason chickens are greatly terrified when they see a hawk sailing about in the air, and they run toward the house as fast as their legs can carry them. The hawk is quite a large bird, and is able to carry off a common-sized chicken with ease. It is very crafty in the manner of procuring its prey. You will see it sailing about in the air in circles as though it were paying no attention to anything on

earth. Many times it is up so high that it can not be seen readily by the domestic fowls, but all of a sudden, down it swoops as straight as an arrow, and catches one or more of its surprised victims, and flies away with it to some tree, there to have a feast or perhaps to divide it up among several of its children who have been waiting some time for something to eat.

The note of the hawk is a shrill, piercing whistle. These birds are great flyers, and will remain on the wing for hours and hours, sailing about in circles. Their food is not restricted entirely to domestic fowls, for often they fly along close to the ground, especially over marshy ground, in search of mice and rabbits. The hawk has a strongly-hooked bill, which is especially adapted to seizing and tearing its prey.

The feet of the hawk are very large and strong, therefore it can carry a very large weight. The claws on the toes are very sharp, and can easily penetrate the flesh of animals which it uses for food. The hawk builds its nest in large trees, up some distance from the ground. The nest is a very crude affair, consisting largely of a pile of sticks and twigs placed promiscuously together. The hawk does not make a very soft, downy bed for its children, but educates them early to live a life which is beset with hardships and difficulties.

The hawk is a common representative of a large family of birds, which are sometimes called the "Lions of the Air." Others call them plunderers, because they live upon the booty which they obtain by robbing other birds, often taking the young of smaller birds before they are able to leave the nest. Besides the chicken-hawk, there are many species of hawks. The sparrow-hawk is so named because it lives upon small birds such as the sparrow. Its general appearance and habits are the same as that of the chicken-hawk.

The plunderers are wild birds, but some of them can be readily tamed. Some of the more common plunderers, aside from the hawk, are the eagle, owl, vulture, osprey, falcon, and

condor. The eagle has been chosen as the emblem of our country on account of its great courage and pluck. The bald eagle is the name of the especial bird which represents our nation. He takes great delight in being present in the time of battle. The nest of the eagle, like that of the hawk, consists of a large pile of sticks thrown together without any special care.

References.—"Parts of His Ways," section 9, chapter 9. Zoology, see Raptores, and birds mentioned in lesson.

Questions and Suggestions.—What is the name of the bird studied in this lesson? Why is it called the chicken-hawk? Describe the manner of its flight. How is it enabled to catch the domestic fowls? Describe the note of the hawk. Upon what does the hawk live besides chickens? Describe the bill of the hawk. For what is it especially adapted? Describe the feet and toes. For what are they adapted? Describe the hawk's nest. What names are given to this large family of birds of which the hawk is a representative? Why are they so called? Name some of the near relatives of the hawk. What bird of this family has been chosen to represent our nation? What does Solomon say that he does not understand about the eagle? Prov. 30:18, 19. Who gives the hawk its ability and power to fly in the mid-heavens? Job 39:26. At whose command does the eagle mount on high? Verse 27. The Bible plainly teaches that God controls the birds, and that they obey His commands. 1 Kings 17:2-6. God is acquainted with all the birds. Ps. 50:11. God's knowledge and control over His creatures should be early impressed on the minds of the pupils. Their ways and habits were given to them by God, but in many ways their habits have changed in consequence of the curse which came as a result of sin.

LESSON X.

The Climbers.

THE WOODPECKER.

Every boy and girl is familiar with the bird called the woodpecker. There are about twenty-five species of this bird, but the most common is the red-headed woodpecker. You will find the "red-head," as it is sometimes called, in orchards and corn fields, where it feasts on ripe cherries and apples, and the rich,

milky, young corn. The woodpecker is a rather clumsy bird, and is unable to light on the limb of a tree crosswise but always lengthwise. Its feet and toes are adapted to climbing rather than to perching. Two toes are directed backward and two forward, enabling it to take a firm hold with its feet. The woodpecker climbs up and down the trees, picking out of the bark the insects which are depositing eggs that would develop into a destroying host.

Some look upon the woodpecker as the enemy of the farmer, because it helps itself so liberally to the fruits and grains which the farmer raises, but were it not for the faithful work of the woodpecker in killing the larvæ and worms so destructive to the fruit trees, the farmer would not have his vines and trees so richly laden as they are with delicious fruit. Surely the farmer can afford to give this industrious bird its board for the noble service it renders.

Besides the "red-head," we have the downy woodpecker, living in parks and in the shade trees around houses; the Arctic three-toed woodpecker, living in northern North America; the California woodpecker; the ivory-billed woodpecker, of the southern states; also the flicker, or golden woodpecker, so common throughout the United States.

Closely related to the woodpecker is the bird commonly called the sap-sucker, because many think that it sucks the sap from the trees, but it is now known that it picks out the small insects and larvæ which it finds underneath the bark, instead of sucking the sap of the tree.

The woodpecker is the representative of a large family of birds whose feet are so constructed that they can climb about very readily. On this account this family has received the name of climbers. The climbers can run up and down trees like squirrels, and it seems to make very little difference whether the head or tail is up foremost. They skirmish to the right and left, whacking the bark with their bills.

The parrot is also a member of the climbing family. Its feet clasp the boughs of the trees as if they were hands. In climbing, it not only uses its feet, but its hooked bill, which aids it very much in getting from limb to limb. The parrot 's a tropical bird, and a strict vegetarian, living upon fruits and grains.

The chimney swallow, or swift, is also a climber. This bird can get up and down the chimney with ease; besides using its feet, its spine-pointed tail is also used to support the body.

The woodpecker begins to build its nest about the middle of May. The nest is formed by making a large cavity in the limb or body of some tree. No material is taken into the cavity, but the nest is constructed of small chips, and in it are placed the six white eggs. They are hatched in about three weeks. About the middle of September the birds start for the south. They travel during the night in an irregular way, stopping during the day to eat and sleep.

References.—"Parts of His Ways," section 9, chapter 10. Zoology, see Picariæ, and birds mentioned in this lesson.

Questions and Suggestions.—Why is the bird in this lesson called the woodpecker? What is the color of its head? What is the color of the rest of its body? What is the favorite haunt of the woodpecker? What constitutes its food? How does the woodpecker's manner of perching differ from that of other birds? Describe its feet and toes. For what are they particularly adapted? For what purpose does the woodpecker climb up and down the trunks of trees? Is the woodpecker an enemy of the farmer? Name other woodpeckers, giving their native homes. What other bird closely resembles the woodpecker? Why was it called a sap-sucker? What is the name of the family of which the woodpecker is a representative? What members of the climbing family live in the tropics? What do they use beside their feet in climbing? What is their diet? What bird living in our chimneys is also a climber? With what besides its feet does it support its body? When does the woodpecker begin to build its nest? How is it made? How many eggs does the woodpecker lay? What is their color? What time is required for them to hatch? When does the woodpecker leave for a warmer climate? When does it take its flight? What does it do during the daytime?

LESSON XI.

The Singers.

THE ROBIN.

The American robin is one of our familiar songsters. It goes by the name of robin redbreast. It is fond of the society of man, following close behind the plow, eating the freshly-turned-up worms and insects. The robin feeds for a month or two on strawberries and cherries; but, generally speaking, its diet consists of worms and insects, so it may be regarded as the friend of man in protecting vegetation from the destructive insects.

The robin is one of the earliest birds of spring, coming as early as March or April, and is one of the last to leave us in the fall. No doubt you have often said, "Spring will soon be here, for I heard a robin sing this morning." The robin's song is sweet, hearty, and melodious. It is often called "the bird of the morning," because it sings its principal song at the early morning hour. Even before the sun rises, it mounts the top of some tall tree, and with its melodious song heralds the coming of day. Before we are up, the parent birds have taken their bath, fed the children, and are ready to greet us with their good-morning song.

The robin builds its nest on some horizontal limb or in the crotch of some tree, or, it may be, in a fence corner, or in the porch of a house. The nest is constructed of leaves or dry grass, cemented together with mud. From four to six bluish eggs are laid, which hatch in four weeks.

The robin is a representative of a very large family of birds, called the singers. The most distinguished of these singers are the thrushes and the mocking-birds. The hermit-thrush, as its name indicates, lives in seclusion in the deep, silent forest, away from the dwellings of man. The wood-thrush is one

of the sweetest of singers. It lives in the woods, and prefers to be heard rather than to be seen. It sings most sweetly when the weather is bad, but, rain or shine, wet or dry, it sings and sings. I wonder if we could not learn a good lesson from the thrush in this respect? The mocking-bird is a wonderful songster. Not only can it sing melodiously, but it has remarkable power of imitating all the birds of field, forest, and garden in one song broken into fragments.

The skylark, a native of old England, is a very sweet singer, and gives forth its most musical carol in the morning, as it rises higher and higher, until it appears a mere speck in the sky. At this great height, the notes are faintly heard, but they gradually grow louder and louder as the bird descends. When it is within a few yards of the earth, the music ceases, and it drops, as a stone hurled, into the bushes.

The meadow-lark is a very common bird in this country, and, as its name indicates, delights to stay in the fields and meadows. The greatest of all bird vocalists is the nightingale, which lives in England. At midnight, when all is still, the nightingale sings most sweetly. Its music, although melodious, has a sad and melancholy air. The singers are a very large family, including many common birds, such as the bobolink, oriole, wren, blackbird, sparrow, chickadee, phœbe, kingbird, etc. But we shall have to learn about these some other time.

References.—"Parts of His Ways," section 9, chapter 11. Zoology, see Passeres, and birds mentioned in this lesson.

Questions and Suggestions.—Why is the bird in our lesson called robin redbreast? Does it choose the society of man? Where may it be found in the early spring-time, when the farmers are plowing? Does the robin live upon insects and worms only? In what way is the robin a friend to man? What does the return of the robin from the sunny south indicate? What time in the year do they return? What time do they leave? What can you say of the song of the robin? At what time of day does it sing its principal song? When do the robins begin to build their nests? Where do they build them? Out of what material are they constructed? How many eggs do they lay? How much time is required for them to hatch? Of what very large

family is the robin a member? What birds in this family are the most distinguished singers? Describe the hermit-thrush. Describe the wood-thrush. What lessons may we learn from it? Describe the mocking-bird. Describe the skylark, and its manner of singing. What is the name of the common lark which is seen in the fields and meadows? Which of all the birds is the greatest singer? Where does it live? At what time does it sing its sweetest song?

LESSON XII.

The Swift-footed Birds.

THE OSTRICH.

The birds we have studied so far are winged creatures which are able to fly about in the air. When the Lord made the birds on the fifth day of creation, He said, "Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven." But there are some birds which never leave the ground, because they have very small wings, which are not able to support their bodies.

The ostrich is an example of this kind of birds. Its breast-bone is flat instead of being keeled, as is that of most flying birds. The ostrich has great strength in its legs, and can outrun the fleetest horse. This bird lives in the dry, parched deserts of Africa. They are kept in very large herds upon what are called ostrich farms. The feathers of the ostrich are of great value in commerce. The female lays her eggs in the sand, with which she covers them, until they are hatched. These eggs are very large, some of them weighing fully three pounds.

A long time ago, the Lord gave to Job a very graphic description of the ostrich and its habits. "Gavest Thou . . . wings and feathers unto the ostrich? Which leaveth her eggs in the earth, and warmeth them in dust, and forgetteth that the foot may crush them, or that the wild beast may break

them. She is hardened against her young ones, as though they were not hers; her labor is in vain without fear; because God hath deprived her of wisdom, neither hath He imparted to her understanding. What time she lifteth up herself on high, she scorneth the horse and his rider." Job 39:13-18.

We see that the Lord, who made the ostrich, has given to us a very plain description of its character.

The African ostrich has two toes on each foot, while those living in South America and Australia have three. The African ostrich, when full grown, is about seven feet high, and weighs from a hundred to two hundred and fifty pounds. Although the wings of the ostrich are too short for flight, they help to increase its speed when running.

The value of the ostrich consists almost wholly in the beauty and value of its rich plumage. In California there are several large ostrich farms. The nest is scooped out in the surface of the sand, and in it several birds may deposit their eggs. The males do the sitting, and are more affectionate to the young than are the females. During the heat of the day the nest is left to be heated by the sun. The ostrich has the queer habit of eating stones, bits of iron and glass, pieces of leather, and almost everything which happens to be lying about. The young birds are plucked at six months of age and about every six or nine months thereafter. The feathers of a grown bird, at a single plucking, have sold for one hundred and fifty dollars.

References.—"Parts of His Ways," section 9, chapter 12. Zoology, see Ratitæ and Ostrich.

Questions and Suggestions.—When the Lord created the birds, where did He design they should live? Have the birds which we have studied so far, the ability to move about in the air? What bird in this lesson is unable to fly? What kind of breast-bone has the ostrich? What kind of breast-bone have the birds which you have already studied? Which kind of breast-bone is the best for flight? Where is the home of the ostrich? What can you say of the size of the ostrich? Is the ostrich a swift-footed bird? How does it com-

pare with the horse in speed? Where, in the Bible, have we a description of the ostrich and its habits? Who gave this description? In your own words, give the points brought out in the description. In what other countries beside Africa is the ostrich found? In what respect does the African ostrich differ from those living in Australia and South America? What is the height of a full-grown African ostrich? How much does it weigh? Are the rudimentary wings of any value to the ostrich? In what does the chief value of the ostrich consist? In what state are there several large ostrich farms? Describe the nest of the ostrich. Which is the more affectionate; the male or the female bird? How is this shown? What queer habit has the ostrich? How old is the ostrich when its feathers are first plucked? How often are they plucked afterwards? What is sometimes the value of a single plucking of a full-grown bird?

LESSON XIII.

The Canary.

The canary is a well-known bird, being a pet bird in many homes. It has a near relative which goes by several different names. It is commonly called the wild canary, but is often spoken of as the "summer yellow bird" or the "yellow warbler." The origin of the tame canary is not definitely known, but it is thought by some to have been brought from the Canary Islands. The tame canary can be trained to sing very sweetly, but the canaries vary in song even as they do in their shape and color. The songs of some of the canaries consist of loud, harsh shrieks, which are very unpleasant to listen to. A young canary will generally pick up any air which is regularly whistled or played on the flageolet in its presence, but the lesson must be frequently repeated.

The wild canary often visits gardens, and seems to be especially fond of lettuce. The male bird has a yellow coat trimmed with black, while the female bird is dressed in a modest brownish-drab attire. The canary goes south to spend the winter, returning about the first of May, when all nature is most fair and inviting. Its nest is lined with the silky down of the dandelion ball woven together with horsehair. The

wild canary has a musical song, saying, "Sweet-sweet-sweet-sweet-sweet-sweet-sweeter-sweeter." This is repeated several times before the song is finished.

The tame canary seems to be as much at home in the cage as are the wild canaries out-of-doors. If the cage door be left open, they will hop out and fly about the room for a time, and then return to the cage and enter it of their own accord. The cage is useful in keeping the cat away from the bird, as well as in keeping the bird from flying away.

All birds are not as readily tamed as is the wild canary. In fact, it is impossible to tame some birds. This was not the condition of things when the Lord first created the world and placed birds in it. Not only the birds but the entire animal creation craved the companionship of Adam and Eve in their Eden home. Whenever you see a cage with an animal in it, it should be to you a reminder of the dreadful work of sin in the world in alienating the beasts from man, who was made ruler over them all. The canary birds belong to the great family of singers which we studied in our last lesson.

References.—Same as in lesson 11.

Questions and Suggestions.—What bird is a common household pet throughout the country? What is the name of its wild relative? From what place is it supposed the canary was brought to this country? Is the canary a musical bird? In what way may its musical talent be developed? Do all canaries sing sweetly? Where is the wild canary frequently found? What garden plant does it especially like? Describe the color of the male and of the female. At what time does the canary go south? At what time of the year does it return? Describe the nest of the wild canary. What does the canary say when it sings? Where would the tame canary prefer to stay, in the cage or outside? Why is it necessary that the wild animals should be placed in cages? Of what should the cage be a reminder? To what large family does the canary belong?

LESSON XIV.

The English Sparrow.

The English sparrows are so familiar to every one that there is no need of my giving you a formal introduction. They were brought to this country from England, in the year 1852. They were brought over to kill the canker-worms, which were so destructive at that time, but the sparrow is very largely a vegetarian, consequently they were not as useful in destroying insects as was expected. The English sparrow multiplies very rapidly, five or six broods being reared in a single season.

Although they have been in this country less than a half century, they are everywhere abundant, not only in the cities, but in the villages and rural places. They seem to be especially fond of living in our villages and cities; in these places they are not liable to be attacked by owls and hawks. Should the sparrow race go on increasing as it has for the last fifty years, there will be in the United States a nation of two hundred and seventy-five billion sparrows in ten years from now. At the present time they have spread over a territory of one million square miles.

The English sparrow is regarded as a nuisance everywhere. A long list of crimes is recorded against it. They delight to go into the garden and play havoc with lettuce, peas, beets, cabbage, and fruit buds, and to eat the fruit of the peach, pear, plum, cherry, apple, and grape. Not only are they destructive to the garden and orchard, but they invade, also, the grain fields; as many as fifty have been seen on a single shock of grain.

They are not contented with their share of the fruit and grains, but they kill or drive away many birds which are useful to the farmer in destroying insects and in cheering his

heart with their sweet songs, so that instead of the inoffensive and musical birds, such as the wren, robin, and song-sparrow, we have the creech-creech of the plunderer,—the English sparrow.

The tussock caterpillar, which is so destructive to the foliage of nearly all trees, is covered with sharp bristles, so that most birds will not touch it, but the oriole, robin, and cuckoo destroy it readily.

It appears from what we have learned of the English sparrow that it will not work to save the farmer's crop, neither will it allow the other birds to do so. What do you think of such a bird as that? They build their nests of grass and strings, hair, and almost anything they can get hold of. These nests you will find located in and about buildings wherever there is a place large enough to contain them. The English sparrow belongs to the family of birds called the singers, and yet it is a very poor specimen of a singer. Some of the relatives of the English sparrow are very sweet singers, and possess very much better dispositions.

References.—"Principles of True Science:" See Sparrow. Other references same as in lesson II.

Questions and Suggestions.—What bird is the subject of this lesson? Where was its original home? In what year were they brought to this country? What was the object of bringing them here? How did the plan succeed? What can you say about the multiplying of the English sparrow? Where do the English sparrows prefer to live? Why? How many sparrows will there be in ten years from now if they multiply as rapidly as they have since being brought to this country? How large a territory do they now occupy? What kind of reputation has the English sparrow? Name the crimes laid up against it. Besides destroying the fruits and grains of the farmer, what else do they do that is detrimental to the farmer's success? How do the sparrows regard insects? What birds are especially helpful to the farmer in destroying insects? In one sentence, what expresses the character of the English sparrow? Where do they build their nests? Of what material? To what family does the English sparrow belong?

LESSON XV.

The American Crow.

Every one is acquainted with the common American crow, which is black in color and a foot and a half long. It is called the American crow because it lives in America. The crow in Japan is called the Japan crow. It is about the same size as the American crow, but is brown in color instead of black. Our crow makes its presence known by cawing, which is not a very pleasant noise, and can not be called at all musical, although the crow is classed among singing birds.

The crow is a very shy animal, and it is difficult to get near enough to it to give it a close examination. If you point a stick at a crow, it will think you are going to shoot, and will immediately dodge if it is on the wing. The crow has a fine eye, which can see a great distance. It has also a long and strong bill. The food of the crow consists chiefly of insects, worms, mice, grubs, and moles, forming rather a soft bill of fare.

Although the crow has a very stout bill, it is not very hard, neither is its stomach adapted to the work of grinding and digesting hard foods. You will find that this rule holds good among birds. A bird with a soft bill has a soft stomach; a bird with a hard bill has a hard stomach, which is capable of grinding and digesting very hard foods. While the crow prefers a bill of fare consisting of soft foods, it will, if driven by hunger, eat hard corn, but it seldom swallows the kernels whole, but instead, picks out the soft portions of the kernel with the curved point of its bill.

Corn-planting time comes before mice, beetles, and birds' eggs are abundant, so when the farmer has nicely completed the work of planting his corn, the crow makes him a visit, and inspects his corn-field to see how well it is planted, and naturally, of course, boards off the farmer while it is investigating.

You have often seen corn-fields which contain one or more figures of old men set up in different parts of the field to scare away the crows. The crow soon finds out that these old men set up about the fields have neither muscle, blood, nor bone. It digs up and devours the corn when in the sprouting condition. At this time it is soft, and can be easily digested.

Crows have a great deal of intelligence, which, when tamed, they exhibit to a marvelous degree. Nothing can go on without their knowing it. They are great fellows to steal things which may be lying about, and they hide them so carefully that they can not be found readily when wanted. By splitting a crow's tongue, it is enabled to talk quite like a parrot.

References.—Same as in lesson 11.

Questions and Suggestions.—What is the full name of the crow which lives in this country? Are there other crows in the world besides the American crow? Where? Do these crows differ in color? How large is the American crow? Is the crow a musical bird? In what way does it make its presence known? Can the crow be easily studied? Why not? Describe its eye. Describe the bill. What is the diet of the crow? What other foods will it eat when forced by hunger? Why does the crow prefer soft foods? What part of the corn does it eat? When does it prefer to eat corn? How do farmers seek to scare away the crows? With what results? What can you say with reference to the intelligence of the crow? What disagreeable habit has the crow inherited? By what means is the crow enabled to talk? Where does the crow build its nest? Of what material is the nest constructed? How many eggs do they lay? (The nest of the crow is built high up in the crotch of some tree.) The material used in building consists of small twigs and sticks, covered with dry leaves. The number of eggs is four. The teacher should endeavor, as far as possible, to teach the children, by actual observation, the facts about the building of the nest and the material used; also the number, color, and shape of the eggs.

LESSON XVI.

The Dove.

The dove is another pet bird which frequents the habitations of men throughout the United States and the world. The dove has a very ancient history, for we read in the Old Testamen scripture that the dove was one of the birds which Noah sent out from the ark to ascertain the state of the waters. The dove returned, bringing an olive leaf in its mouth, which indicated to Noah that the waters were abating from off the earth. The dove also was used in the sacrificial system which the Lord instituted for the children of Israel. When the individual sacrificing was too poor to provide a lamb, the Lord instructed him to offer a dove; so when Christ was presented at the temple, his parents, being very poor, offered the dove in sacrifice instead of the lamb. The dove has become recognized as an emblem of peace, from the use which was made of it in the sacrificial system.

The dove is a very harmless creature, and is well fitted to represent the harmlessness and innocence of the great type, Christ, of which it was the antitype. When Christ was baptized in the Jordan by John, the Spirit of God descended upon Him in the form of a dove.

The tame doves build their nests in houses which are provided for them. The nest is constructed of dried grass and similar materials. The tame dove has some wild relatives which go by the names, mourning-dove, turtle-dove, and the wild pigeon. The mourning or turtle-doves are smaller than the wild pigeons, and are usually found in pairs. They spend most of their time in the fields and along the road. They build their nests on stumps or in low trees. They consist of a few sticks placed promiscuously together. They are very simple affairs, not being lined with any soft materials. They

lay but two eggs. The wild pigeons move in great flocks. When migrating, much of the sky is often obscured with these great flocks of birds.

The wild pigeon, next to the frigate-bird of the ocean, is the swiftest of all birds on the wing. It travels at the rate of seventy to a hundred miles per hour. It is safe from the attacks of larger and stronger birds, such as the hawk and eagle, when it is on the wing. The pigeon is truly a bird of the air. It sleeps in the tree-tops, and builds its nest also in the trees. The common barn doves and all the fancy birds of this family are derived directly from the wild rock pigeon of England.

Pigeons live upon fruit, seeds, and grain. They have a good stomach and a double crop, which is capable of digesting shucks and kernels, however hard they may be. After they are softened, they are ground up by the gizzard with a pair of ribbed millstones. The young pigeons when hatched are both naked and blind, and are carefully looked after by both the parent birds. The pigeons have glands which secrete from the food a kind of milk, which is fed to the young bird. This is the nourishment which the old birds pump into the mouths of their young until they are able to take stronger food.

The pigeon does not drink like the chicken, or as other birds usually do, but like a horse; it places its bill in the water, and holds it there until it has finished. The true carrier-pigeon is very valuable in the carrying of messages. It is trained for this purpose by being taken short and then long distances from home, and allowed to return on wing. Persons traveling in the northern regions usually take along a number of these pigeons, that they may send back word to their home and friends. The Romans employed this method of carrying news in time of war.

References.—"Parts of His Ways," section 9, chapter 13. Zoology, see Columbæ, Turtle-dove, and Pigeon.

Questions and Suggestions.—What is the name of the bird described in this lesson? What can you say of its history? Of what was it a type in the sacrificial system? When were the Israelites permitted to use the dove as an offering? What offering was made when Christ was presented at the temple? Why? What took place when Christ was baptized? Of what is the dove an emblem? Where do doves build their nests? Of what material? What wild relatives has the dove? Where are the mourning or turtle-doves usually found? Where do they build their nests? Of what material? How many eggs do they lay? Describe the wild pigeon and its manner of migration. What can you say of the speed of the wild pigeon? What means does it use to escape the attacks of larger and stronger birds? What shows it to be truly a bird of the air? From what bird are all the different members of this family derived? Upon what does the pigeon live? Describe their digestive system. Describe the young pigeons when they are first hatched. What is the food of a very young pigeon? How and where is it obtained? How does the pigeon drink? Compare its method of drinking with that of the ordinary bird.

LESSON XVII.

God's Care for the Birds.

1. On what day did God create the birds?

2. What place did God design should be the home of the birds?

3. From your study of the birds have you found that God's original plan has not been fully carried out with reference to their home?

4. Is God acquainted with all the birds? Ps. 50:11.

5. Can any harm come to them without the knowledge of God? Matt. 10:29-31; Luke 12:6, 7.

6. What bird does the Lord ask us to study? Luke 12:24. Should we study other birds besides the raven? Matt. 6:26, 27.

7. What are we to learn from the study of the raven? *Id.*

8. What lessons did we learn from the study of the lily?

9. What will the birds teach us? Job 12:7, 9, 10.

10. Does the Lord control the birds? Num. 11:31; Ps. 78:26-28; 105:40.

11. What birds did the Lord command to feed Elijah? 1 Kings 17:2-4.

12. What did they bring to him? How often did they bring flesh and bread? Verse 6.

13. Where did they obtain this food? Ps. 147:9.

14. Are any of the birds used as symbols in the Scripture?

15. What part will the birds have in the great battle that is to be fought by all the nations of the earth? Rev. 19:17-21.

16. Did the Lord, when He created the birds, intend they should be subject to man? Gen. 1:26; Ps. 8:6-9.

17. Are the birds and other animals accountable to God for what they do, the same as man?

References.—"Principles of True Science:" See Birds. "Parts of His Ways," section 9, chapter 14.

Suggestions to Teachers.—In this lesson you can bring vividly to the minds of the pupils the power of God over the birds. They do His bidding. They depend upon God for their food. They carry out His commands more faithfully even than man. The birds and all the lower animals are not accountable to God for their actions, for they do not sustain a moral relation to Him. They are not responsible for their wrong acts; these are due to man's sins.

LESSON XVIII.

The Birds of the Bible.

1. Upon what day did God create the birds? What other animals were created at the same time?

2. Name some of the water animals which you have observed and studied. What valuable lessons have you learned in the study of the water animals?

3. Name some of the birds you have observed and studied.

4. How many birds have you listed in your bird calendar, which was suggested in lesson two?

5. What valuable lessons have you learned in the study of birds?

6. Name some of the birds which are mentioned in the Bible, and give the reason why they are mentioned. *Ans.*—

(1) The bittern. Isa. 14:23; 34:11; Zeph. 2:14.
(2) The crane. Jer. 8:7.
(3) The dove. Matt. 10:16; Jer. 48:28.
(4) The eagle. Ex. 19:4; Ps. 103:5; Deut. 32:11; Rev. 12:14; Isa. 40:31.
(5) The hawk. Job 39:26.
(6) The hen. Matt. 23:37; Luke 13:34.
(7) The owl. Isa. 13:21; 34:11-15.
(8) The ostrich. Job 39:13, 14; Lam. 4:3.
(9) The peacock. Job 39:13.
(10) The stork. Jer. 8:7.
(11) The sparrow. Ps. 84:3; Matt. 10:29.
(12) The raven. Luke 12:24; Isa. 34:11.

7. Learn what you can about the birds which live in Palestine at the present time.

8. In what respect are the saints to be like the birds? *Ans.*—They will have the power of flight. G. C., p. 677. Do the angels fly? Give proof.

Suggestions to Teachers.—This closes the chapter on birds. This last lesson shows that God refers to this part of His creation to illustrate the truth He desires His children to learn. Many other examples might be taken up which would be of great interest. Have the pupils draw birds and their eggs and nests. The next chapter will be on land animals. The two previous chapters should be briefly reviewed before taking up the next. Use suitable pictures to illustrate the lessons on plants and animals.

Chapter X.

THE LAND ANIMALS.

(Scripture Basis, Gen. 1 : 24–26.)

LESSON I.

Creation of the Land Animals.

1. What two classes of animals did the Lord create on the fifth day of the creation week?

2. Where were these animals to live?

3. Out of what were the water animals created? Gen. 1:20, 21.

4. Out of what were the air animals created? Gen. 2:19.

5. Name and describe some of the animals studied thus far.

6. What animals did God create on the sixth day. *Ans.*—The land animals and man. Gen. 1:24-27.

7. What was to be the home of all the animals created on the sixth day? *Ans.*—The dry land.

8. How are these creatures classified in verse 24? *Ans.*—

(1) As beasts.

(2) As creeping things.

9. Name some of the common beasts. *Ans.*—The horse, cow, sheep, lion, bear, dog, cat, mouse, rat, etc.

10. Name some of the common creeping things. *Ans.*—Spiders, bugs, ants, centipeds, millipeds, and all insects in the larval stage.

11. Out of what did God make the land animals? Gen. 1:24; 2:19. The plants? Gen. 1:11; 2:9.

12. How did He create the animals? The plants? *Ans.*—By His word.

13. In what respects are the land animals unfitted to live in the water? In the air?

14. In what ways are they adapted to a home on the dry ground?

15. What had the Creator caused to appear on the dry land that would sustain the lower animals? Gen. 1:30.

16. What was God's purpose in making the lower animals? P. P., p. 45.

17. Did Adam and Eve study the animals as well as the plants? P. P., p. 51; C. E., p. 207.

18. Should we study them? Why? Job 12:7, 9, 10.

References.—"Parts of His Ways," section 10, chapter 1.

Suggestions to Teachers.—In this chapter we take up the study of land animals. God made three homes for the animals; the first two have been studied, and the third is now before us for study. Compare the water animals and birds with the land animals, as to their structure, habits, and food. Notice how the cow, horse, sheep, etc., are constructed, as regards their hair, teeth, feet, etc., so that they are adapted only to a life on the dry land. Adam and Eve studied the animals as well as the plants, and Adam gave to them their names. We are to study them also, and learn more of God's character by so doing. Our next lesson will be God Controls the Land Animals.

LESSON II.

God Controls the Land Animals.

1. Is the Lord acquainted with the land animals? Ps. 50:7-11. (Read the margin of verse 11.)

2. What new thought is brought out by the marginal reading? *Ans.*—Not only do the beasts of the field belong to God, but they are with Him also.

3. Does the Lord control the creatures which live on the land, as well as those which live in the air and water? *Ans.*—

(1) Balaam's ass. Num. 22:22-33. What enabled the ass to speak?

(2) The ark drawn by two cows. 1 Sam. 6:1-14. Had the cows ever drawn a cart before? Would the cows naturally want to go away from home? Why not? Who drove the cows? What did they do as they went along the road? Where did they go?

(3) Daniel in the den of lions. Dan. 6:16-24. Why did not the lions destroy Daniel? How did the animals treat Daniel's accusers? Why?

(4) Jesus rode on the young colt of an ass. John 12:12-15; Matt. 21:1-8. Had this young colt been ridden before? What did the people do that would frighten an unbroken colt? Why did not the colt become frightened and run away?

(5) The plague of lice. Ex. 8:16-19.

(6) The plague of flies. Verses 20-24.

(7) The plague of locusts. Ex. 10:12-20.

(8) God prepared an insect which destroyed Jonah's gourd. Jonah 4:6-8.

4. Will God rebuke the troublesome insects? On what conditions? Joel 2:25-27; Mal. 3:10, 11.

Suggestions to Teachers.—After learning in the preceding lesson of the creation of the land animals, we now take up the study of God's control over them, even now. The above instances show plainly that the lives of these creatures are in God's hand. The children as they notice and observe the animals will associate God with them all. God created all the animals to be ministering servants to one another and to man. Not only the animals, but also the plants, in fact, all things, are engaged in the work of ministry. Read "Desire of Ages," pp. 18, 19. Christ says that He came not to be ministered unto, but to minister. Matt. 20:28. All the angels are ministering servants sent forth to minister unto those who are heirs of salvation. Ps. 103:20, 21; Heb. 1:13, 14.

LESSON III.

Many-Footed Animals.

THE MILLIPED AND CENTIPED.

We will begin our study of the land animals by studying the creeping things. We shall notice the many-footed creatures first. Most of the creeping animals are insects, usually called worms. But they are not worms, as you have learned in a previous lesson; they are the larval, or worm-like, condition of the insect when it first comes forth from the egg. The many-footed creatures are not true insects. The word insect means "cut in" or "almost divided." But this is not the case with the milliped and centiped members of this family, which are supplied with so many legs and feet.

The true insect, as a general rule, has only six legs, while the milliped or "thousand-legged worm," as it is commonly called, has a great many legs. The milliped is from three to six inches long, and brownish-red in color. It lives in great numbers in timbered countries, and will be found crawling around on the ground and over old stumps and logs. You will find them at rest under stones, logs, etc. If you touch one of them, it quickly winds its body up into a coil and pretends to be dead. If left undisturbed for a few moments, it will gradually unfold itself and start again on its journey. The milliped lives upon vegetable food.

The centiped resembles the milliped in that it has many feet—as the name indicates, about one hundred of them. It is not as large as the milliped, and has a more flattened body. These creatures live about dwellings and feed upon small animals. Both the centiped and milliped are harmless creatures, and yet the large centiped of the tropical regions (some of them a foot long) is capable of inflicting very severe and

even dangerous wounds. Both the millipeds and centipeds have bodies which consist of many ring-like segments. Each segment of the centiped has two legs, while each segment of the milliped has four.

References.—"Parts of His Ways," section 10, chapter 2. Zoology, see Arthropoda, Myriopoda, Milliped, and Centiped.

Questions and Suggestions.—Into how many classes are the land animals divided? With which class do we begin our study? What creatures go to form the larger part of this class? What is the meaning of the word "insect"? What family of creepers are we studying in this lesson? How many legs has the true insect? What two familiar animals belong to the many-footed creatures? How many legs has each one? Describe the milliped. Where do they live? What do they eat? Describe the centiped. How does it differ from the milliped? Of what does the body of the milliped consist? Of the centiped? How many legs has each segment of the milliped? How many has the centiped? How many segments in the body of each? Of what value are the milliped and centiped? There are so many creatures in the world, and all with different customs and habits, that the question will naturally rise in the minds of the students as to why God created them, since many of them are so troublesome and annoying. Here you can show that God made all things good, but sin has diverted many things from His purpose. Read in this connection Sp. G., vol. 3, p. 75, which indicates that many animals exist to-day which God did not create, but which are the result of amalgamation of the species.

LESSON IV.

The Web Spinners.

THE COMMON SPIDER.

The common spider needs no introduction to most pupils; therefore the study will be of interest as it is watched from day to day. It makes its presence known to the housekeeper by festooning the walls and ceilings of her house with its webs. The spider is a carnivorous animal, feeding upon insects and flies. It is well provided with weapons whereby it can secure and kill its prey. Just in front of the first pair of legs is a pair of jointed feelers, with which it feels its way along.

The mouth is armed with a pair of jaws, which are attached above the mouth and hang down in front, at the end of which are the poison fangs. With these the spider poisons and paralyzes its prey. Just behind these two large jaws are two smaller ones, which are used to crush the food and arrange it for the mouth.

Not only can the spider run about, but it is also able to suspend its body in mid-air by making a rope just for the occasion. This rope is secured to a limb or to the ceiling, and the spider lets its body down, making the rope as it goes. If it desires to go back, it climbs up the same rope by which it came down, and gathers it up as it ascends.

If you will examine closely the abdomen of the spider, near the hinder end, you will find some little appendages. These are the spinnerets, with which the spider spins its web. The spinnerets are covered with hollow, jointed hairs, and through these the web-forming material escapes. This material is a fluid, and looks something like the white of an egg. The fluid from the different tubes unites and forms a thread composed of many strands. This fluid dries rapidly when it is exposed to the air. As the thread is made, the spider guides it with its hind pair of feet. These are curiously adapted not only for holding and guiding the thread, but also for enabling the spider to run rapidly across the web without getting entangled, as is the case with the insects when they attempt to do the same thing.

The spider has not only eight legs, but also eight eyes, situated on the front part of the thorax, instead of on the head. They look like small black beads, and can be easily seen in large spiders.

The female spider weaves a case, in which she deposits her eggs. The most common case is oval in shape, and may be found suspended in barns and sheds. Collect some of these cases and break them open. If the eggs have hatched, you

will find hundreds of small spiders moving about in the nest.

The spider family is exceedingly large, and includes grand-father-long-legs, lice, mites, ticks, and many others, which you will study sometime later. The scorpion and tarantula, which live in tropical regions, are very poisonous members of the spider family.

References.—"Parts of His Ways," section 10, chapter 3. Zoology, see Arachnida, and the creatures mentioned in this lesson.

Questions and Suggestions.—What common animal is the subject of this lesson? Where does it live? What constitutes its food? How does it secure its food? Describe the weapons of the spider, giving their location and use. How does the spider suspend its body in the air? Describe the spinning organs. Of what does each thread consist? How does the spider build its web? Watch a spider build a web; make a drawing of it, and write up a description, telling how the whole thing is done. Describe the eyes and legs of the spider. How are new spiders produced? Collect some egg cases; examine and draw them. What can you say as to the size of the spider family? Name some of the near relatives. What members are poisonous? Where do they live? To what is the hypocrite's hope and trust compared? Job 8:13, 14. Why? What members of the spider family are mentioned in the Scripture? Is the spider a wise creature? Prov. 30:24-28. What does it use in building its web? *Id.*

LESSON V.

The Two-Wing Family.

THE HOUSE-FLY.

This insect is so common that it would seem as if we ought to know all about it, yet very few children, or even grown people, can give the life history and the habits of this common insect. The fly has two gauzy wings, with bronze and purple tints. The wings and legs are attached to the thorax, the middle portion of the body. By examining the fly with a small hand-lens, you will see that its body, as well as its legs, is covered with small, stiff hairs. Those on the legs the fly converts into combs or brushes; and with these it cleans its body.

The fly has a short bill, or beak, which it uses in obtaining liquid food. Doubtless you all have reasons of your own for knowing that the fly has a bill. It also has feelers reaching forward from the head, and two round eyes. The microscope shows that each of these eyes is composed of thousands of little eyes, fitted closely together.

The foot of the fly is curiously constructed, enabling the insect to walk on walls and ceilings with perfect ease. The last joint of the foot contains two claws; and under each of these is a pad, or soft cushion, covered with knobbed hairs. From these hairs flows a sticky fluid, which causes the foot to adhere to the surface sufficiently to sustain the weight of the body, even when the fly is walking on the ceiling. Where the surface is rough, the delicate claws are brought into use.

Has the fly ears and a nose as well as eyes?—None have been found; but some suppose that these senses are situated in the feelers, as is the case with many insects.

The fly has no bones; but the body is surrounded with a thin, horny case, which serves as a skeleton. The skeleton of most animals is on the inside of the body, while that of insects is on the outside. The fly has no gills, no lungs; but the air passes into the body through little holes in the horny case. These open into little air-sacs, which are spread out through the body. The hen lays an egg from which a chicken is hatched; but the fly lays an egg which hatches, not into a little fly, but into a small white grub, about one-third of an inch in length. Did you ever see one of these baby flies? The mother fly lays her eggs in the litter found about stables and elsewhere. The small grubs eat heartily for about a week, and then change into a shell-like case called a "chrysalis." In two weeks this chrysalis bursts open, and a full-grown fly steps out, dries its wings, and flies away.

References.—"Principles of True Science:" See Insects. "Parts of His Ways," section 10, chapter 5. Zoology, see Insecta and Diptera.

Questions and Suggestions.—Of all insects, which one is the most common? Why is it, then, that we know so little about it? How many wings has the house-fly? What is their color? How many parts has the body of the fly? To which part are the wings and legs attached? With what is the entire body as well as the legs covered? What use is made of the small, stiff hairs on the legs? Describe the beak of the fly. For what purpose is it used? Describe the head of the fly. How many feelers has it? How many eyes? Of what is each eye composed? Describe the foot of the fly. How is it enabled to walk upon the ceiling? Where the surface is rough, what besides the sticky fluid is brought into use? Has the fly ears and a nose as well as eyes? Has the fly bones? With what is the body surrounded? In what way does the fly breathe? In what do these little pores open? In what way does the fly multiply? Where are the eggs deposited? Describe the process of development from the egg to the adult fly. Find instances in the Bible where the Lord used flies as an agent of destruction.

LESSON VI.

The Two-Wing Family (Continued).

THE MOSQUITO.

The mosquito is another member of the two-wing family. It spends the first part of its life in the water. The eggs, when laid, are so glued together that they form a little boat. In a week these eggs hatch, and then appear the countless larvæ, or "wigglers," so often seen in stagnant pools. When the water is quiet, these wigglers may be seen on its surface, heads downward, sucking in air through the hairy tube near their tails. If the water is disturbed, they instantly wiggle to the bottom.

After ten or fifteen days they change from the larval form to the pupal form. The pupa sheds its skin several times, and tumbles about in the water by means of two paddles, but after ten days of this life the case bursts open along the back and forms a boat. The mosquito sticks out its head, then one pair of legs after another, until all are free; then it balances itself on its tail, waiting for its legs to grow strong and its wings to dry.

This is the critical period in the life of the mosquito, and many of them are shipwrecked by a sudden gust of wind or a drop of water. But if no harm overtakes the insect, it spreads its wings at the right moment, and sails away to seek its food, which consists of the blood of animals and the juices of plants. Only the females bite; the males, which live only a short time, remain in the woods and marshes.

The mosquito has two feelers, and a beak, which is divided into six parts. First is the upper lip, which is grooved so as to receive the tongue; then come the large jaws, which might properly be called fangs, since they contain poison; next to these is a pair of small jaws, barbed at the end, which work back and forth like saws. When the mosquito bites, all these parts are pressed into the upper lip, and form an awl-like beak.

The May-fly, or day-fly—for in its fully-developed state it lives only one day—is another two-winged insect. Although it lives about three years in the water, it lives only one day on the land—just long enough to deposit its eggs.

References.—The same as in preceding lesson.

Questions and Suggestions.—What very common insect is considered in this lesson? Of what family is it a representative? Why is the family so named? Where does the mosquito spend the first part of its life? Where are the eggs deposited? Describe their color and size. How much time is required for them to hatch? What are the larvæ of the mosquito called? Where may these wigglers be found? What position do they take in the water? What are they doing when near the surface? When the water is disturbed, what happens? After ten or fifteen days, what form do the wigglers take? Describe what takes place while in the pupal condition. Describe the exit of the mosquito from its boat-like pupal. Is this a dangerous period for the mosquito? Why? Upon what food does the mosquito live? How can you tell the difference between the male and the female mosquito? Where do the male mosquitoes stay? Describe the feelers and beak of the mosquito. How many parts has the beak? Name some of the relatives of the mosquito. Why is the May-fly sometimes called the day-fly? How long does it live in water? What does the May-fly do during the one day of its aerial existence?

LESSON VII.

The Straight-Wing Family.

THE GRASSHOPPER.

The straight-wing family is represented by the grasshopper and the locust. Most of us are acquainted with these insects, for they are abundant everywhere. They are called straight-wings because the front pair of wings are long and straight. These wings are thicker than those folded beneath them. The hind pair are very thin and delicate, and are folded up like a fan when the grasshopper is not flying. The thick front wing serves as a protection to the others.

The grasshopper has long and very strong legs. These strong legs enable it to jump long distances. If it desires to go farther than it can jump, it uses its wings. When the grasshopper is young, its wings are not strong enough to carry its body, but when it is full grown, the wings are quite large. Usually it flies but a short distance before it alights.

Grasshoppers differ from the insects already studied in that they do not pass through so many changes. The young grasshopper, just from the egg, does not look like a worm or grub, but almost like the mother grasshopper. It is short and thick-set, and has small wings which look like little scales. The young grasshopper eats greedily the green grass and leaves. Every little while its coat gets too small and splits open, and the grasshopper crawls out. Before it sheds its first coat, another is made underneath. Before the young grasshopper is full grown it has six coats. The last coat does not seem to wear out, but lasts as long as the insect lives.

The eggs of the grasshopper are buried in the ground by an instrument which it always carries with it, called the "ovipositor," meaning the "egg depositor." With this instrument a hole is dug in the ground, and the eggs are placed in

it. Before the eggs are covered with earth they are covered with a gluey substance, which hardens and preserves them during the winter.

The locust, cricket, katydid, etc., belong to the straight-wing family. The mother straight-wing lays the eggs, while the father furnishes the music. This music is produced by drawing one wing across the other, or by rubbing the wings with the legs, much as a violinist draws the bow across the violin strings.

References.—"Parts of His Ways," section 10, chapter 6. Zoology, see Orthoptera, and insects mentioned in this lesson.

Questions and Suggestions.—To what family does the grasshopper belong? Describe the wings of the grasshopper. In what respect do the two pairs of wings differ? Describe the legs of the grasshopper. How many has it? What use is made of the very large pair of legs? Which does the grasshopper use the most, its legs or its wings? In what respect does the grasshopper differ from the insects already studied? Describe the young grasshopper. What does it eat? As it grows in size, what change takes place in its outer coat? How often is this process repeated? How do grasshoppers multiply? Where are the eggs deposited? What is the instrument called which it uses in boring a hole in the ground? With what are the eggs covered before they are covered with earth? What is the object in covering the eggs with a gluey substance? Name other members of the straight-wing family. How does the male grasshopper spend his time while the female is depositing her eggs? How is this music produced? What musical instrument produces music in accordance with the same principle? What does the Lord say are in His sight as grasshoppers? Isa. 40:22. In what way are they as grasshoppers? Study the grasshopper carefully, noticing all the points brought out in this lesson. Draw a full-grown grasshopper.

LESSON VIII.

The Half-Wing Family.

THE HARVEST-FLY.

The harvest-fly, or cicada, is a representative of the half-wing family, which is so named because half of the front pair of wings is thickened, so that it resembles the sheath-wings of the beetle, while the remaining half is membranous or wing-

like in structure. The harvest-fly is a good type of this family. These flies are sometimes called locusts, but this is not their right name. They develop slowly, one species—the "seventeen-year locust"—requiring seventeen years to reach maturity. Another requires thirteen years.

The female deposits her eggs in the stems of various plants by means of a sharp-pointed instrument with which she is provided. When the eggs hatch, the young insects drop to the ground, and burrow quite deeply, attaching themselves to the roots of various plants. They live on the sap, which they suck from the roots. When they are full-grown, they come to the surface of the ground, creep up the stems of plants, shed their skins, and appear as winged insects, ready to deposit eggs for the next generation. These empty insect cases may often be found where the occupant has left them.

Those of us who have had much experience in picking berries are acquainted with the stink-bug, so called because of its unpleasant odor. This bug often falls into the pail with the berries.

The electric-light bug, or giant water-bug, as it is sometimes called, has become well known since the advent of the electric light. Both in the spring and in the fall, these insects, after dark, leave the water, to fly about in search of new waters in which to deposit their eggs. At this time they are attracted by the electric lights, and large numbers fly about these lights till they become injured or dazed and fall to the ground. Good specimens can easily be obtained for study. Chinch-bugs, so destructive to growing grain, are also well-known members of the half-wing family.

References.—"Parts of His Ways," section 10, chapter 7. Zoology, see Hemiptera, and the insects mentioned in this lesson.

Questions and Suggestions.—What insect forms the subject of this lesson? Of what family is it a common type? What is the meaning of the family name? Which pair of wings is called half-wings? What name is sometimes given to the harvest-fly? What can you say of the development of the harvest-fly? How many years

are required to develop from the egg to the adult? Where are the eggs deposited? How are they placed within the stems? What becomes of the larvæ after hatching? Upon what do they live? When the larvæ are full grown, what do they do? What near relatives of the harvest-fly can you name? Why does the giant water-bug bear the name electric-light bug? When do the electric-light bugs fly about? Where do they deposit their eggs? What is the best means of securing this insect for study?

LESSON IX.

The Nerve-Wing Family.

THE DRAGON-FLY.

The nerve-wings are so called because they all have nerve-like threads, or veins, running through the wings, which make them very strong. The dragon-fly is a well-known member of this family. In some places it is called the "snake-feeder," and in others the "mosquito-hawk." I think the latter name most appropriate, for a large portion of its food consists of mosquitoes. The mosquito-hawk has four large, rainbow-tinted wings, so that it is quite a beautiful creature during its aerial life. In its early life it is an ugly-looking insect, living in the water of some slimy, filthy ditch.

The female mosquito-hawk pushes the end of her body down into the water, and glues a bunch of little yellow eggs to the stem or root of some water-plant. In a few weeks these yellow eggs have changed into water-nymphs. They grow rapidly, for they eat all the little fish and young tadpoles that come in their way. Like the young grasshopper, they shed their coat many times.

At last some small wings are seen; then they change into the chrysalis, or resting stage; in a few days they crawl out of the water upon some reed or stem, and the chrysalis bursts open. In a short time the wings are strong, the legs are freed, and the beautiful insect sails away to live a happy life in the air and sunshine.

The lace-winged butterfly is another beautiful member of the nerve-wing family, but because its body emits an unpleasant odor, it is not a favorite with naturalists. The dragon-fly is sometimes called the devil's darning-needle. This name sounds rather savage, and does not represent the true character of the insect. It is perfectly harmless, and can be taken in the hands without danger.

The best way to study the dragon-fly and similar insects is to place them under a glass dish and watch them carefully from the outside. The dragon-fly does not walk about as insects usually do, but flits about, lighting from time to time on sticks or stones. It is usually found flying up and down the streams, where it is seeking a place to deposit its eggs, and also searching for food.

References.—"Parts of His Ways," section 10, chapter 8. Zoology, see Neuroptera, and insects mentioned in this lesson.

Questions and Suggestions.—What is the name of the family of which the dragon-fly is a type? Why is it so called? What are some of the common names by which the dragon-fly is known? Which one do you think is the most appropriate? How many wings has the dragon-fly? What is their color? Where is the earlier life of the dragon-fly spent? How are the young dragon-flies produced? Where are the eggs deposited? What is their shape and color? What are the young dragon-flies called? Upon what do they live? What changes take place while they are growing rapidly in the water? How often do they shed their coat? What insect have we already studied that sheds its coat? What change takes place in the nymphs after a few days? How does the dragon-fly make its exit from the water? What other insect has nerve-wings like the dragon-fly? What is the best way to study these insects?

LESSON X.

The Sheath-Wing Family.

THE POTATO-BUG.

The Colorado beetle, or potato-bug, as it is commonly called, is a good type of the sheath-wing family. The members of this family have two thick, heavy, sheath wings, which serve as a protection to the thin, delicate wings folded beneath them. Many persons make no distinction between a beetle and a bug. There is quite a difference, however, as you will notice in a close study of each.

The true bugs belong to the half-wing family, which has already been briefly described. You will remember that the stink-bug, squash-bug, and electric-light bug were mentioned as common types. These have a long sucking tube, which is folded under the breast when not in use. They use the tube for sucking the juice out of plants.

Beetles have two or three sets of strong, horny jaws, which they use in cutting and biting the roots, stems, and leaves of plants.' Most of the beetles are vegetarians; but a few live on animal food, which usually consists of smaller insects.

The wing-covers of the beetle meet in a straight line down the back, instead of overlapping each other, as they do in the bug. When the beetle wishes to fly, it lifts the wing-covers, spreads its wings, and flies away with a buzzing noise, which is neither very musical nor agreeable. Its favorite time for flying is at evening twilight.

We shall not have time to study many of these sheath-wing creatures, but will begin with one which is familiar to every boy and girl who lives in the country. It is the common potato-bug, or "Colorado beetle," as scientists call it. We used to gather potato-bugs much as one would pick berries, but

nowadays some poison, such as Paris green, is sprinkled over the potato vines, and the insects are thus destroyed.

The full-grown potato-bug deposits its eggs on the under side of a leaf, sometimes as many as fifty or sixty, all standing on end, and crowded close together. After a few days the eggs hatch into a sort of reddish, worm-like larva. It is at this stage that the insect does so much damage. It eats greedily, and in a few days increases to many times its larva size. If all the eggs laid in the spring were destroyed before hatching, the potato crop would not suffer seriously from these voracious eaters.

When the larva is fully developed, it goes down into the ground, and passes through the pupal stage. There it remains about two weeks, when it comes forth a full-grown beetle. In some places three generations are produced in one season; the larvæ of the third generation go into the ground, and do not come out of the ground until the next spring, when they deposit their eggs for the first family of the new year's potato-bugs.

References.—"Parts of His Ways," section 10, chapter 9. Zoology, see Coleoptera, and insects mentioned in this lesson.

Questions and Suggestions.—Of what family is the potato-bug a common representative? What is the meaning of the family name? Describe the sheath-wings of the potato-bug. What purpose do they serve? What is the difference between a beetle and a bug? Describe the jaws of the beetle. For what purpose are they used? Upon what kind of diet do most of the beetles live? What movements does the beetle go through before it is able to launch itself into the air? What causes the buzzing noise when beetles and other insects are flying? Would you call this buzzing sound music? When is the favorite time for beetles to fly? Where does the full-grown potato-bug deposit its eggs? How many do they put upon a single leaf? How are they arranged? What is the appearance of the young larva? Upon what does the larva feed? During what period of the potato-bug's life is it the most destructive? What means do farmers use for destroying potato-bugs? When the larva is fully developed, where does it go? How long does it remain in the ground? What change takes place? How many generations may be produced in a single season? How do potato-bugs live through the winter? Do the full-grown potato-bugs or the larvæ appear first in the spring?

LESSON XI.

The Scaly-Wing Family.

THE CABBAGE BUTTERFLY.

All are acquainted with the great family of butterflies and moths, for they are found everywhere in large numbers. The moths and butterflies, when in the larva state, are usually called worms; but this is a wrong name for them, as you have learned in a preceding lesson. The cabbage butterfly is perhaps the most familiar representative of the scaly-wing family. This family is so named because of the dust-like particles with which their wings are covered. These particles, under the microscope, look like little scales. The cabbage butterfly is rather small and white in color.

About the last of May or the first of June it may be seen fluttering over cabbage, radish, and turnip beds, seeking for a place to deposit its eggs. The eggs are fastened to the under side of leaves, but seldom more than three or four are placed on the same leaf. The eggs are yellow, nearly pear-shaped, and about one-fifteenth of an inch in length. A week or ten days is required for the eggs to hatch, and the caterpillars which are produced from them become full grown when about three weeks old, at which time they measure about one inch and a half in length.

On account of being the same in color as the leaves of the cabbage, they are not readily found. They do not eat the edge of a leaf, but begin anywhere on the under side, and eat irregular holes through the leaf. When they have completed their growth as caterpillars, they leave the plants and retire to a stone wall or some old building, and there pass into the pupa stage.

This is done by spinning a little tuft of silk, in which they entangle the hooks of their hindmost feet; then they form a

loop to sustain the forepart of the body in a horizontal or upright position. Bending its head on one side, the caterpillar fastens to the surface, beneath the middle of its body, a silken thread, which it carries across its back and secures on the other side. This operation is repeated until the united threads have formed a band or loop of sufficient strength.

On the following day it casts off the caterpillar's skin, and becomes a chrysalis. This is sometimes of a pale green and sometimes of a white color, regularly and finely dotted with black. The chrysalis state lasts eleven days, at the end of which time the insect comes forth a butterfly. If you wish to secure the chrysalis of the cabbage butterfly, you can easily do so by placing boards horizontally an inch or two above the surface of the soil. Here it will be easy to find and collect them, either in the caterpillar or chrysalis state.

Another very common butterfly is the large yellow insect, which had the honor of naming the family, because of its color resembling that of butter.

Moths may be distinguished from butterflies by the position of their wings. Butterflies keep their wings erect, while the moth's wings are spread out flat. Moths are more destructive than butterflies. Collect the larvæ of butterflies, and watch them spin their cocoons. The larva commonly called the tomato-worm is very interesting to observe.

References.—"Parts of His Ways," section 10, chapter 10. Zoology, see Lepidoptera, and insects mentioned in this lesson.

Questions and Suggestions.—What members of the insect family are found everywhere in large numbers? What are they called when in the larva stage? Is this name correct? Why are moths and butterflies called scaly-winged creatures? What insect is a very common representative of the scaly-wing family? Describe its size and color. Where may it be seen about the last of May or the first of June? For what is it seeking? Where are the eggs fastened? How many are deposited on a single leaf? Give the color and shape of the egg. How much time is required for the eggs to hatch? How large is the egg? How large is the full-grown caterpillar? Describe the manner in which they eat leaves. Where do the caterpillars go after they have completed their growth? Describe the process they pass through

in building the chrysalis. Describe the chrysalis. How long do they continue in the chrysalis state? How may the chrysalis and the caterpillar be readily secured? Give the origin of the name "butterfly." How may moths be distinguished from butterflies? Which are the most destructive?

LESSON XII.

The Membranous-Wing Family.

THE HONEY-BEE.

The honey-bee is the most interesting member of the membranous-wing family, so called on account of the delicate, membranous structure of their wings. Bees are divided into three classes,—queens, drones, and workers. Wild honey-bees make their home in the hollow of some tree. Unlike the ant, they make comb, composed of many six-sided cells. In these the queen deposits her eggs.

It seems strange that some of them should develop into queens, some into drones, and others into workers; but each class of bees has differently-constructed cells, and is fed on a different kind of food. The drones are fed upon food consisting of a mixture of pollen, honey, and water, while the queens are given a more stimulating food, called "royal jelly." Were all the queens to die, the bees would feed this "royal jelly" to a young larva of the workers, not more than three days old, and it would develop into a queen.

Like the ants, the bee family becomes so large that part of them colonize and found a new home. This division is caused on account of the jealous feelings which the queen has when she hears the piping sound of the young queen which is about to come out of her cell. The old queen would destroy her daughter, but the workers will not allow her to do so, so she leaves the hive, and many of the workers go with her. This dividing of the household is called "swarming."

The workers collect nectar and pollen from flowers. The pollen is gathered into little pollen sacs, one on each hind leg. The nectar is sucked through a tube into the stomach, where part of it is made into wax and the remainder into honey, which the bee places in the strong, six-sided cells. The wax is an oily substance, and becomes waxy in appearance when it comes to the surface of the body. The wax is removed from the body by the legs; then it is chewed to render it suitable for making comb. The material which the bees use for food is called "bee-bread." This is a mixture of pollen-dust and nectar. The honey-bee gathers more of the nectar than it needs, and makes it over into clear, sweet honey, which we use on the table.

Bees are valuable to the farmer because they carry the pollen-dust around from flower to flower, thus fertilizing the flowers, that they may bear seed. Were it not for the bumble-bee we would have no clover, because there would be no seed. The bumble-bee has a long tube, or tongue, which enables it to obtain the nectar from the long, slender flower tubes; and while doing this, the pollen is carried from flower to flower, and deposited on the pistils, thus fertilizing the seed.

Much might be said about other members of this interesting family, but we shall have to stop without saying anything about the habits of the bumble-bee, hornet, wasp, and yellow-jacket. All of them gather nectar from flowers, but they are not so industrious as the honey-bee, so they gather only enough to satisfy their present needs.

References.—"Parts of His Ways," section 10, chapter 11. Zoology, see Hymenoptera, Bee, Hornet, and Wasp.

Questions and Suggestions.—To what family of insects does the honey-bee belong? Why is the family so named? Name the classes into which bees are divided. Where does the wild honey-bee make its home? Describe the comb of the honey-bee. Where does the queen deposit her eggs? How do the eggs of the queen develop into the three different classes of bees? What food is fed to the drones? To the queen? Is there any difference in the cells of the queen, drone, and worker? If all the queens were to die, how would a new queen

be developed? What takes place among the bees when the family becomes too large? What is this separation called? What causes the bees to swarm? How is the nectar taken from the flowers by the bees? How do they gather pollen? How do the bees make wax? How do they make the comb? What is the food for the young bees called? Of what is it composed? What is honey? In what way are bees valuable to the farmer? What particular plant does the bumble-bee visit which is of great value to the farmer? Name other members of the membranous-wing family. Do all of them gather nectar from the flowers? How do they compare with the honey-bee in industry?

LESSON XIII.

The Membranous-Wing Family (Continued).

THE ANT.

Solomon thus advises the lazy man to study the ant, and learn from it lessons of thrift and industry: "Go to the ant, thou sluggard; consider her ways and be wise."

Let us study the ant and learn the ways and habits given it by the Creator. There are three classes of ants,—the queen, the drone, and the worker. Only the queens and the workers have wings. The upper wings are the larger, and are fastened to the lower wings. The work of the queen is to lay the eggs, and as fast as she drops them, the workers take care of them.

It requires about one month for the eggs to hatch, and during the larval stage the young are fed by the workers. After a short time they change to the pupal stage, remaining in this for five or six weeks. During all this time the workers act as nurses, looking carefully after the needs of the young insects.

You have seen the eggs many times while the nurses were carrying them about. They greatly resemble a kernel of boiled rice. Perhaps you have seen the ants carrying the eggs out of the nest and leaving them near by in the sunshine. After a few hours they would carry them back into the nest again.

Why do they do this?—It is too cold down in the ground for the eggs to develop, so they bring them out that they may be warmed.

When the little ant is ready to begin its busy life in the world, the nurse bites off one end of the pupa-case, and lets the little captive free.

After some of the eggs are hatched, the nest is often overcrowded, so part of the family take up quarters in some other suitable place. You have noticed, probably, a long line of ants leaving an ant-hill; some were carrying eggs, some carrying larvæ, and others the pupæ. They were moving. They usually select a warm, sunshiny day for going to their new home.

All the workers—and they are workers, indeed—take hold in earnest, turning the earth out of the hill, thus making hallways and galleries in which to live and care for their young. Their nest is usually situated near a tree, so that their cows may live on the sap contained in the roots. Why, do ants keep cows?—Yes, there is a plant-louse which secretes a sweet juice called "honey-dew," and of this the ants are very fond. The ants treat their cows kindly, and take care of the young calves. In milking, the ant presses the body of the plant-louse with the fore legs, and the honey exudes from the two glands.

References.—"Principles of True Science:" See Ant. "Parts of His Ways," section 10, chapter 11. Zoology, see Hymenoptera.

Questions and Suggestions.—Who advises the lazy man to study the ant? What will he learn by studying it? How did Solomon know this? Did Solomon study the things of nature? Eccl. 1:13. Into what classes are ants divided? Have all of them wings? Describe their wings. What is the work of the queen? What do the workers do? How much time is required for the eggs to hatch? How long do the young ants remain in the pupal stage? Who looks after the young ants during the stages of development? What does the pupa of the ant resemble? Why do the ants bring the eggs out of the nest? How does the young ant get free from the pupa-case? When

the ant family becomes too large for its home, what is done? What is done with the eggs, larvæ, and pupæ? What kind of day is chosen for moving? Describe an ant home. Why is their home usually situated near a tree? What is the name of the cow of the ant? How do they treat their cows? Describe the milking process.

LESSON XIV.

The Pocket Animals.

THE OPOSSUM AND KANGAROO.

The mammalia are divided into several families, and first we will study a family which has pockets. Have animals pockets?—A few of them have, and I am going to tell you about two of them; one of them lives in the southern part of the United States, and the other in Australia. Can you guess their names? The one in Australia is called the kangaroo, and the one in the southern states is the opossum. The colored people are very fond of the opossum, so much so that it is often found on the table as an article of diet.

The pocket is a pouch on the under side of the body. What is the purpose of this pocket?—When the kangaroos and opossums are born, they are very imperfect and small in size. They are put into the pocket of the mother, and are nourished until they are large enough to take care of themselves. A certain young kangaroo was measured when twelve hours old, and found to be a little over one inch in length, while a full-grown kangaroo measures from six to nine feet in length. As soon as the kangaroo is born, the mother takes it in her fore-paws, opens her pouch, and deposits it within. When the young are sufficiently matured, they leave the pouch, returning at will.

Some opossums have no pouch, or but a rudimentary one, and the young remain firmly attached to the nipples at first, but afterward are carried on the back of the parent. It may puzzle one to know how the little fellows retain their places

when the mother is moving so actively among the branches of the trees. But they guard against the danger of falling by twining their long, slender tails about that of their mother.

The kangaroo has strong hind legs and a large, strong tail, which enable it to make great leaps, somewhat like a rabbit. The opossum goes out at twilight or during the night; during the day it lies hid among the bushes, in a hollow tree, or on the branches. It feeds upon small quadrupeds, birds, eggs, insects, mollusks, and even fruit, or young vegetable shoots, from which it sucks the sap. It is especially fond of turkey, and often visits the farmer's poultry yard. If surprised by the farmer, it lies down and pretends to be dead. Many animals feign death; this is very common among insects.

References.—"Parts of His Ways," section 10, chapter 12. Zoology, see Marsupialia, and the animals mentioned in this lesson.

Questions and Suggestions.—Give the class name of the animals described in this lesson. Why are they so called? Name the two most common representatives of the pocket family. Describe the pockets of these animals. Where is the home of the kangaroo? Describe the young kangaroo. How are they cared for? What is the size of the young kangaroo? Of the adult? How does the kangaroo travel about? How does it protect itself from danger? Describe the opossum. Describe the nourishing of the young. How do the young travel about? Upon what does the opossum live? How does the opossum behave when disturbed by its enemies? Why? What other animals can you name which do the same thing?

LESSON XV.

The Toothless Animals.

THE SLOTH, ANT-EATER, AND ARMADILLO.

All the mammals are vertebrates, for they have a backbone. The pocket animals, which we studied in our last lesson, are the lowest and queerest of the vertebrates that we shall study. The toothless animals are curious creatures, and are thought to have but little sense. They received the name "toothless

animals" because some of them have no teeth at all, while in others the teeth are absent from the front part of the jaw. These creatures are unknown to most of you, because they live in foreign lands. They are interesting objects, however; therefore, we must have a short study about them, even if we may not have the privilege of seeing them. I shall describe but three of the most interesting ones,—the sloth, the ant-eater, and the armadillo.

The sloth is so named because of its lazy habits; and yet if it wants to move, it can get about as lively as most animals. It lives entirely among the trees, passing from tree to tree, hanging on the under side of the limbs with its four legs, instead of scampering about on the top of the limb, as do squirrels and monkeys. When the day is calm, it sleeps, suspended from a limb; but just as soon as the wind begins to blow, it moves about. Then is its most favorable time, for the swaying of the trees by the breeze causes the branches of different trees to come closer together, enabling the sloth to pass from limb to limb without dropping to the ground.

The feet of the sloth are so constructed that it can not walk on the ground, for they have no soles, but consist usually of two or three long claws, which are very useful in climbing. If the sloth be placed on quite rough ground, it drags its body along very clumsily. It is no more at home on the ground than a hen would be in water. The sloth is wholly a vegetarian, living on leaves and fruit. Its home is, for the most part, in the tropical regions, ranging from the southern portion of Mexico to Rio de Janeiro, in South America. The sloth tribe numbers but few, and lives in gloomy forests, where poisonous snakes take up their abode, and where dismal swamps, with thorny bushes and shrubs, obstruct the steps of civilized man.

The armadillo is found in South America, but differs much in appearance and habits from the sloth. The armadillos are

burrowing animals, and for this purpose they are provided with strong claws for digging. The upper surface of the body is covered with a heavy coat of mail, which is formed of hard, bony plates united at the edges. This peculiar covering causes them to look something like a rat running away with a turtle-shell. Their food consists partly of animal and partly of vegetable substances and fruits. The giant armadillo is over three feet in length, but the other representatives are quite small.

The ant-eater, as the name signifies, is a lover of ants. Most of the ant-eaters have no teeth; if any are present, they consist of a few molars; but they have long, cylindrical tongues covered with sticky saliva, which furnishes the means for entrapping the prey. The body is covered with hair, and some of the ant-eaters have long, bushy tails. Their bodies are sometimes three or four feet long. Some of them, when threatened with danger, will roll themselves up like a hedgehog.

References.—"Parts of His Ways," section 10, chapter 13. Zoology, see Mammalia, Edentata, and the animals mentioned in the lesson.

Questions and Suggestions.—What family of animals is described in this lesson? What family was studied in the last lesson? Are the toothless animals well known? Why not? Why are they called toothless animals? What three members of this family are the most common? Where do they live? Describe the sloth. What does it eat? When is it most active? Describe the home of the sloth. Describe the armadillo. How does it differ from the sloth? What does it carry on its back? What does it resemble? What does it eat? Describe the ant-eater. Describe its tongue and teeth. Of what does its food consist? How does the ant-eater behave when threatened with danger?

LESSON XVI.

The Gnawing Animals.

THE RABBIT.

The rabbit is an innocent, harmless creature, possessing no disposition to quarrel and fight. It has long ears, which enable it to hear very acutely. It builds its nest usually underground, making it of leaves, grass, and fur from its own body. It is a familiar type of a very large family of animals known as the gnawing family. Their teeth are so constructed as to enable them to gnaw the bark from trees and roots. The gnawing animals are very numerous, and are to be found everywhere, even on board the ships which navigate the seas. Mice, rats, squirrels, and beavers are familiar members of the gnawing family, and are very interesting to study.

Many persons suppose that the rabbit and hare are the same creatures, but this is not true. They resemble each other in many respects, but still they are easily distinguished. The hare has longer ears and thighs than the rabbit; its body is more slender, and its coat of fur is of a deeper fawn-color. The hare lives in hilly or level regions, forests, or fields; it does not burrow in the ground, while the rabbit does.

During the daytime the hare does not usually stir from its nest, but as soon as the sun begins to sink in the west, it goes forth to seek its food, which consists largely of roots, herbs, and leaves. It is especially fond of sage and parsley. The rabbit lives in societies. It is not found on the open plain, but chooses its home where there are hillocks and woody banks. The rabbit, like the hare, goes forth in the evening to search for its food.

The rabbit has many enemies, and in order to escape them it takes refuge in its home beneath the ground. The burrow, which may be either straight or crooked, ends in a circular

apartment, furnished with a bed, which consists of leaves and fur. On this bed the young are reared.

Every time the mother rabbit leaves her burrow, she carefully closes the entrance, so that no harm may come to her young children. In about twenty days they are able to provide for themselves, and are strong enough to do without the protection of their parents. They remain together, and soon make a burrow for themselves, where they live in common. The family usually numbers from four to eight.

In many countries the rabbits and hares do a great deal of damage to the farmers' crops. This is especially true in Australia. Even in California they are found in great numbers, and do much damage in gnawing the bark from different kinds of fruit trees. The rabbit is a common pet animal in all countries; and in many places, especially in the country districts in France, they are reared in great numbers, and sold at such prices that they are quite a source of revenue.

References.—"Parts of His Ways," section 10, chapter 14. Zoology, see Rodentia, and the animals mentioned in the lesson.

Questions and Suggestions.—What animal is the subject of this lesson? What can you say as to its disposition? Describe its ears? Where does it build its nest? Of what materials is the nest made? Of what large family is the rabbit a familiar type? Why is it so called? Name some of the common members of this family. Is there any difference between a rabbit and a hare? Describe both of these creatures, giving their points of resemblance and difference. Where does the hare usually live? At what time does the hare seek its food? Of what food it is especially fond? Where does the rabbit choose to live? When does it search for its food? Of what does it consist? How does the rabbit escape from its enemies? Describe the underground home of the rabbit. What precaution does the mother rabbit take on leaving her burrow? How long do the young rabbits need the care of their parents? What is the usual size of a family of rabbits? Where do the children live when old enough to take care of themselves? In what places are rabbits troublesome to the farmers? In what way? In what respect do the rabbit and hare resemble the cow? Lev. 11:6.

LESSON XVII.

The Gnawing Animals (Continued).

THE GRAY SQUIRREL.

In this lesson we will consider another member of the gnawing family, called the gray squirrel. It is a handsome animal, and full of life, as are all the squirrels. Its jaws are armed with strong teeth, and the four front ones are very sharp. There are two of these on each jaw, and they are shaped like the edge of a chisel. The more these chisel-shaped teeth are used, the sharper they become. They seem never to wear out, but are constantly renewed from the roots.

Squirrels are very fond of nuts, and carry their nut-crackers with them wherever they go. The gray squirrel has whisker-like hairs growing on each side of its face. Its nose is rather blunt; its cheeks, nose, and ears are of a yellowish-brown color. Along the sides of the body is a stripe of the same color. There is a dull stripe of brown extending from the top of the head to the tail. The rest of the body is of a light gray color. It has a long, bushy tail, of which it seems to be quite proud. This tail is of great service to the squirrel when jumping from high elevations to the ground. The tail is extended horizontally when jumping, and offers considerable resistance to the atmosphere. When at rest, or running about from limb to limb, the tail is usually carried in a vertical position.

There are many varieties of the squirrel, some of the more common ones being the red squirrel, black squirrel, ground squirrel, and flying squirrel. Squirrels live chiefly upon hazel-nuts, beech nuts, acorns, almonds, chestnuts, and fruit. Thus we see that the squirrel is a vegetarian when allowed to have a choice in the matter of diet. If deprived of nuts and fruit, the squirrel will attack birds'-nests, and suck the eggs, or

devour the young. In northern countries they eat the seeds of the pine and of the fir tree. Squirrels are also very fond of grains, such as wheat, corn, etc.

They manifest considerable forethought in the matter of storing up provision in summer, hence they do not suffer from hunger in winter. They not only provide food in one place, but conceal it in many places, that they may not be left destitute should they be robbed of their principal storehouse. They hide away their food in the trunks of trees, and occasionally in the ground. The squirrel has an excellent memory, so that it never fails to find the places where its food has been stored away.

The nests of squirrels are usually placed in a crevice between two branches of a tree, or in a hole in the trunk. Their homes are made of little bits of dry wood interwoven with moss. They are nearly round in form, and large enough to contain the father and mother with three or four children. At the top of the nest is an opening just large enough to allow the entrance and exit of the squirrels. In order to keep the rain out of the nest, the squirrel places above the opening a slanting shelf, which carries off the water, and preserves the home from becoming water-soaked.

The habits of all squirrels are very much the same, but they differ considerably in the matter of size and color. The great fox squirrel of North America is probably the giant among the squirrels.

References.—The same as in lesson 16.

Questions and Suggestions.—What is the name of the animal studied in our last lesson? Of what family is it a member? Name several members of the gnawing family. Which one forms the subject of our lesson for to-day? Describe the teeth of the gray squirrel. What keeps them sharp? Why do they not wear out? Describe the head of the gray squirrel; describe the variations of color on the head and body; describe the squirrel's tail. Of what value is it? Name some of the more common squirrels. Of what does the squirrel's diet consist? Does this bill of fare seem to agree with it? When only will it eat flesh food? In what way does the squir-

rel manifest forethought? What creature previously studied stores up food for winter? Where does it store up its food? In what way does it protect itself against intruders? Has the squirrel a good memory? In what way is it shown? Where do squirrels build their nests? What material do they use? What is the form of the nest? How large a family will it contain? How do they keep out the rain? In what respects do they differ? What is the name of the giant squirrel?

LESSON XVIII.

The Flesh-Eating Animals.

THE CAT.

The cat is a very common domestic animal, and it would seem as though we ought to know all about it, since we see it in and about our homes every day. We have not only tame cats, but wildcats also are found in different parts of the world. They live in the woods and climb about in trees. The wildcat is a reddish-brown animal, having more or less distinct black stripes on its body. It is about two feet long. It climbs trees very swiftly, and from some limb it quickly pounces down upon its prey. It feeds upon birds, squirrels, hares, rabbits, etc.

Some believe that the numerous varieties of the domestic cat descended from the wildcat; that is to say, that all the cats were wild at one time, but that a great many of them have been tamed. This can hardly be true, for at the present time it is impossible to tame the wildcat so that it will be gentle and docile. It seems much more in harmony with the Bible to think that the cat and all other animals were tame in the beginning, and that many of them, on account of sin and ill treatment by man, have escaped from his dominion, and now it is impossible for him to control them as Adam did in the beginning.

The cat is a very common type of a large family of animals called the flesh-eaters. If you examine the cat closely, you

will see that its feet are cushioned so that it can move about very noiselessly, and steal upon its prey unawares. Its teeth are adapted to flesh eating. There are four long, sharp teeth, two in each jaw, which are used in tearing flesh. The cat very much resembles its wild relatives, the tiger and the leopard. Both of these animals have very strong, muscular bodies, and are able to leap great distances.

Another member of the flesh-eating family which is found in the domestic state is the dog. The teeth of the dog are very much like those of the cat, but the dog is very different in disposition. The cat is a cowardly and dishonest creature; it is untrustworthy. Notice the eyes of a cat and of a dog. The cat has a suspicious look, while the dog has a frank and confiding look in its eyes. The cat has no desire to be of use to its master, while the dog is ever ready and willing to go at his bidding. The dog constantly seeks the good-will of its master, and quickly forgets any mistreatment that it may receive.

If you speak unkindly to a dog, it feels pained and grieved; you can see this in its eye and in its actions. Now speak pleasantly to it; its eyes sparkle, and it jumps about and wags its tail to express its delight at having once more the good-will of its master.

The cat is not an entirely useless animal, for it helps to get rid of the troublesome rats and mice about the home; but it does this simply to gratify itself, not its mistress. The lion, bear, panther, wolf, and fox are other members of the flesh-eating family; but we shall have to study about these at some future time.

References.—"Principles of True Science:" See Lion. "Parts of His Ways," section 10, chapter 15. Zoology, see Carnivora, and the animals mentioned in the lesson.

Questions and Suggestions.—What common domestic animal is considered in this lesson? What is the name of its nearest wild relative? Where does the wildcat live? What is its color? What is its size? How does it secure its prey? Upon what does it feed?

What is thought to be the origin of our domestic cat? What do you think about it? Give proof for your answer. Of what large family is the cat a type? What enables the cat to move about so noiselessly? Describe the teeth of the cat; for what are they adapted? What can you say about the strength of these animals? What domestic animal besides the cat is a member of the flesh-eating family? Compare the cat and dog as regards disposition. Which is the most useful? Which is the most self-sacrificing? Mention other wild relatives of the flesh-eating family.

LESSON XIX.

The Flesh-Eating Animals (Continued).

THE DOG.

The dog has a history which reaches back as far as does that of man. In many places in the Scriptures the dog is spoken of in connection with man. Examine the mouth of a dog, and you will see that it contains four very long teeth, called canine teeth. These answer the same purpose in the dog as in the cat. The dog is a more noisy creature than the cat. When after its prey it goes with a bark and a bound which frighten its victim, while the cat creeps along quietly and stealthily, without any sound.

The dog is very useful to man in many ways. Nearly one thousand years ago there lived a man by the name of St. Bernard, who used to treat his dogs very kindly. He was often heard to say, "He who loves me, loves my dog." The St. Bernard dogs are very large and strong, and possess a kind and self-sacrificing spirit. They have rescued the lives of many human beings who, but for them, would have perished in cold, mountainous regions. The Newfoundland dog is also much used in preserving human life. There are many instances on record where dogs have saved the lives of children and grown people from a watery grave.

There are many varieties of dogs, some of the most common being the greyhound, water spaniel, poodle, pug, bulldog, and

shepherd-dog. Probably the shepherd-dog is the most valuable about the farm, for driving cattle and sheep. It is not savage toward either man or beast.

The nearest wild relative of the dog is the wolf. It is thought by some that the dog is a descendant of the wolf; however, there does not seem to be any bond of sympathy between these two creatures. The wolf is a very cruel animal, and is very destructive to the farmers' sheep and poultry. Wolves usually go in herds, and at such times are willing to attack any animal, even the lion. When alone, the wolf is very cowardly. The coyote very much resembles the wolf, but is considerably smaller in size, and has a very sneaky appearance. The fox is another flesh-eater, and has a very cunning disposition. It is especially fond of poultry, and is usually successful in securing its game. The fox looks considerably like the dog, but is much smaller.

The dog is subject to one terrible disease, which is called hydrophobia. When suffering from this disorder, we say the dog is mad. The symptoms of the malady are loss of appetite, inflamed eyes, suffering from thirst, and yet drinking no water, because, it is thought, the swallowing of water increases the pain. Some dogs, when attacked by this disease, become sulky, and express their feelings by a hoarse, melancholy cry. In later stages of the ailment, the dog runs here and there without purpose, biting at whatever comes in its way,—cats, dogs, men, women, and children.

The poison of the saliva enters the system of animals that are bitten by the mad dog, and they in turn suffer from the same affection. The best way to prevent the spread of this disease is to kill the mad dog, and also the animals which have been bitten. If the sufferer be a human being, a physician should be called to administer treatment.

References.—The same as in lesson 18.

Questions and Suggestions.—Of what large family is the dog a member? How old is dog history? Is the dog spoken of in the

Scriptures? Compare the teeth of the dog with those of the cat. What are the four long teeth called? In what ways is the dog useful to man? Describe the St. Bernard dog; how did it come to receive its name? What expression did St. Bernard make with reference to his dogs? Describe the Newfoundland dog. What instances can you relate showing the self-sacrificing spirit of dogs? With how many species are you acquainted? Which do you think is the most useful? What animal is the nearest wild relative of the dog? How do the dog and wolf regard each other? Of what animal is the wolf especially fond? Describe the disposition of the wolf. Describe the coyote. Describe the fox; compare it with the dog and with the wolf. To what terrible disease is the dog subject? What are the symptoms of this disease? What are the effects of the bite of a mad dog? How may the spread of this disease be prevented?

LESSON XX.

The Thick-Skinned Animals.

THE ELEPHANT.

The elephant is the largest of the animals which live upon the dry land, while the whale is the largest of the animals which live in the water. The elephant is a very strong animal, and has a very imposing and noble appearance. It is rather awkward and clumsy in its gait. The elephant belongs to the thick-skinned family. Some of its near relatives are the rhinoceros and hippopotamus. Sometimes the wild boar and the hog are classed in this family also.

The elephant has two very large, thin ears, which extend in all directions from the head. These it uses in fanning itself, and for scaring away the flies. Its eyes are very small for so large an animal. Its mouth also is quite small, and is almost entirely hidden behind the tusks and base of the trunk.

The trunk of the elephant is very peculiar in its shape. It is merely the nose prolonged to a great length, and has the shape of a tube, terminating in two small openings, called nostrils. It uses its trunk in many ways. In it are located

the senses of smell and touch. It uses it as a hand to convey food to its mouth, and also as a weapon with which to fight its enemies. With it it can seize and pick up very small objects, such as a piece of money or a straw. It uses its trunk also for lifting heavy weights and for putting them on its back, and for drinking, by filling it with water, and then letting the water pour down into its throat.

The elephant is a vegetarian, and has no canine teeth, such as the dog and the cat possess, which live on flesh-food. The diet of the elephant consists of grass or fresh leaves. It is especially fond of sugar-cane tops. The elephant is a very intelligent animal, and can be trained to do a great many difficult things. It is very kind and docile when properly treated, but avenges unkindness without mercy.

When the elephant passes through a large crowd of people, it opens a passage for itself with its trunk, and gently presses forward its fore limbs in such a manner as to hurt no one. The elephant is very fond of children. In India the mother often leaves her young child in the care of one of these great giants.

The rhinoceros is not so large as the elephant, and has not so long a nose. It has on its nose one or two solid horns, which are used as weapons of defense. The elephant has two long tusks composed of ivory, one growing on each side of the trunk.

The hippopotamus, which means river-horse, is another very large animal belonging to the thick-skinned family. They are so large and clumsy that they do not spend much of their time on the land, but swim about in large rivers, keeping only their eyes and nostrils above the water. They also live upon vegetable foods, which they procure along the banks of rivers and streams. The Lord speaks to Job of a very large animal, called the behemoth. You will find a record of this in Job 40:15-24. Some think the behemoth is the ele-

phant, and others that it is the hippopotamus. Read the description carefully, and see which one of these creatures you think it best fits.

References.—"Parts of His Ways," section 10, chapter 16. Zoology, see Pachyderms, and the animals mentioned in the lesson.

Questions and Suggestions.—What creature is the largest of the land animals? Of the water animals? The birds? What is the general appearance of the elephant? To what family does it belong? Why is the family so named? Name other members of the thick-skinned family. Describe the ears and eyes of the elephant. Where is the mouth located? What is peculiar about the nose of the elephant? What use does it make of its ears? Of its trunk? How does the elephant drink? Upon what does it feed? Of what plant is it especially fond? What can you say of the intelligence of the elephant? Of its disposition? How is its kind disposition manifested? Describe the rhinoceros. Of what are the tusks of the elephant composed? What king, spoken of in the Bible, had a throne constructed of ivory? Describe the hippopotamus. Where do they live? Of what does their diet consist? What animal do you think is described in Job 40:15-24?

LESSON XXI.

The Hoofed Animals.

THE HORSE.

The animals we have studied so far have toes which terminate in claws, but now we come to the study of a family whose toes are protected by a hard, horny covering called a "hoof." The cat and other animals which have long, sharp claws, use them in catching and holding their prey. This is never done by the hoofed animals such as the horse, cow, and pig. The pig holds down the ear of corn with its foot while it is eating, and the horse paws away the snow to reach the grass. But the principal use made of the hoof is in walking and kicking.

The toe of the horse is covered with a hard, bony wall. When this animal is shod, the nails are driven into this hard substance. On the flat bottom of the foot, within the wall,

is the frog, shaped like the letter V. Between the frog and the wall is the sole of the foot. It is just inside the shoe. The wall, frog, and sole are used to support the body of the horse.

The horse has many cousins, some of them wild and some domesticated. They include the ass, burro, mule, zebra, etc. They are unlike the horse in that they have large ears and a rasping voice. They resemble the horse as regards teeth, hair, lips, legs, and skin. The zebras are beautifully-striped animals which roam the wilds of Africa.

Burros and donkeys look as if they felt themselves extremely ill-treated. They are valuable on account of their great strength and power of endurance. They can carry burdens nearly equal to their own weight, through the desert, without drinking for two or three days, when the thermometer registers one hundred degrees during the day.

The horse is the most serviceable of all the domestic animals. If properly treated, it is always willing to render prompt and obedient service, and many times will work even beyond its strength. The horse is probably as old as man himself. In the books of Moses, the horse is often referred to in connection with war. The Lord has given us a description of the horse in the thirty-ninth chapter of Job, showing how it behaves in time of battle. "Hast thou given the horse strength? hast thou clothed his neck with thunder? Canst thou make him afraid as a grasshopper? the glory of his nostrils is terrible. He paweth in the valley, and rejoiceth in his strength; he goeth on to meet the armed men. He mocketh at fear, and is not affrighted; neither turneth he back from the sword. The quiver rattleth against him, the glittering spear and the shield. He swalloweth the ground with fierceness and rage; neither believeth he that it is the sound of the trumpet. He saith among the trumpets, Ha, ha; and he smelleth the battle afar off, the thunder of the captains, and the shoutings."

References.—"Parts of His Ways," section 10, chapter 17. Zoology, see Ungulata, and the animals mentioned in the lesson.

Questions and Suggestions.—What familiar animal is the subject of this lesson? Describe its general appearance. In what respect do the feet of the horse differ from the feet of the animals previously studied? For what purpose does the cat use its sharp claws? For what purpose do the hoofed animals use their feet? Describe the foot of the horse. When the horse is shod, into what part of the foot are the nails driven? What letter of the alphabet is seen on the bottom of the horse's foot? What is this usually called? Name the three parts of a horse's foot. Name some of the wild relatives of the horse. In what respect do they differ from the horse? In what respect do they resemble it? Describe the zebra. Where does it live? Name some of the domesticated relatives of the horse. Describe the burro and the donkey. In what ways are they of service to man? What is the disposition of the horse? Can you tell anything of the character of the horse's master by studying the disposition of the horse? Give the history of the horse. Where is it first mentioned in the Scriptures? For what purpose did they use the horse in ancient times? Esther 8:10; 2 Kings 9:18, 19; Ex. 15:19-21. Where do we find a description of how the horse acts in battle? Who gives this description? Is He able to give it correctly? Why?

LESSON XXII.

The Hoofed Animals (Continued).

THE COW.

The cow is another hoofed animal, but instead of having one toe, it has two. The horse is valuable for the work it can do, but the cow is valuable for the milk it furnishes the household. Oxen are often used instead of horses for pulling and hauling. The cow has many wild relatives, which resemble it in that they have two toes, and the body is covered with hair. There are many different breeds of cows; some of them are natives of foreign countries.

Among the domestic cows of different countries are some very odd-looking creatures. The Hungarian cow has long, straight horns. The sacred cow (zebu) of India carries a queer hump on its shoulders. The yak of Tibet has extremely long hair. It runs wild, like the buffalo, but is easily tamed.

There are several kinds of cows in this country. We may divide them into families, for convenience. The Ayrshires are from Scotland. They have long, spreading horns, and are red and white in color. They yield a large quantity of milk. The Holsteins were brought from Holland, where the dairy-maids milk the cows, and where the cow-stable joins the kitchen, and is kept as clean as the kitchen. The Jersey's native home is on an island bearing the same name, situated in the English Channel. They are small creatures, but are great butter-makers, their milk being extremely rich. The Alderney and Guernsey cows came from islands bearing their names, near Jersey Island. The round, dark-red Devons, with graceful white horns, came from Devonshire, in England. Do you live on a farm? If so, what family or families of cattle are represented in your father's dairy?

Many of the hoofed animals chew the cud. Instead of having one stomach, they have four. Their food first enters a large stomach, called the paunch. They fill the paunch during the pleasant part of the day; and when night comes, or when the sun is hot, they lie down and chew a cud. The grass passes from the paunch into a second stomach, where it is separated into small parcels and thrown up into the mouth. Here each mouthful is well chewed and mixed with saliva, then it is sent on to the other two stomachs, where it is thoroughly digested. The tame cud-chewers are the cow, camel, sheep, and goat. The wild cud-chewers are very many; among them are the buffalo, gnu, wild sheep, goat, giraffe, elk, deer, reindeer, and antelope.

The pig is also a hoofed animal, but has four toes instead of two like the cow. The wild relatives of the pig are the wild boar and the hippopotamus. We shall have to leave it to you to study the pig and its wild relatives, as our time is already up. The horse and cow are the hoofed animals which are of the greatest service to man. The Creator made

all the lower animals to love and serve man; but many of them now, on acount of sin, are his enemies.

References.—The same as in lesson 21. Zoology, see Ruminantia.

Questions and Suggestions.—To what family does the horse belong? The cow? In what respect does the foot of the cow differ from that of the horse? Name other animals which have the foot divided. Which is of the greatest value to man, the horse or the cow? In what ways are cattle of service to man? How does the cow differ from the horse in general appearance? Do the cows of different countries look alike? Describe the cow of Hungaria, India, and Tibet. Do the cows in this country differ in appearance? Name several different breeds of cows. Describe the Ayrshires. Where is their native home? Describe the Holsteins. From what country were they imported? Who does the milking in Holland? Where do the Hollanders keep their cows? Describe the Jersey cattle. Where is their native home? From what places were the Alderney, Guernsey, and Devonshire cattle imported? If you live on a farm, give the names of the different breeds of cattle represented in your father's dairy. What peculiar habit do most of the hoofed animals have? Can you name any hoofed animals that do not chew the cud? Describe the stomach of the cow. How many apartments has it? What takes place in each apartment? How is the food thrown back into the mouth? Name some wild animals that chew the cud. Describe the feet of the hog; in what respect does the hog's foot differ from the foot of the horse and the cow? Name some of the wild relatives of the cow.

LESSON XXIII.

The Hoofed Animals (Concluded).

THE SHEEP.

The sheep is another member of the hoofed family, and one which is very common. We have found the cow and the horse to be very useful animals in many ways; but the sheep also is very serviceable. The horse is useful in traveling and in hauling heavy loads; the cow is helpful in furnishing milk and butter; the sheep is beneficial in furnishing material for clothing. The domestic sheep has a very close relative which roams about in the west, called the Rocky Mountain sheep. It is much larger and more graceful in appearance than the domestic animal; it also has very large horns.

The deer, goat, antelope, and elk are all near relatives of the sheep. These wild creatures seem to be more hardy and more graceful in appearance than are the sheep. The domestic sheep, in fact, has a rather weak constitution, and would soon die off were it not for the care and protection given it by man. The skin of the wild sheep produces two kinds of hair, one being straight and stiff, and the other wavy and curly. This is commonly called wool.

Wild sheep, deer, antelope, etc., usually have bodies covered with hair, while the body of the domestic sheep, as a rule, is covered with wool. In some cases the wool of sheep is very coarse; but in others, it is very fine. In the spring of the year, as warm weather approaches, the farmer or the shepherd relieves the sheep of their warm, woolly coats, which have been of such service during the cold winter months. This is done by placing the animal on a table and clipping off the wool with shears. Frequently the sheep are washed before being sheared. The sheep are afraid of water, therefore the washing is no delightful occasion to them, while it may be to the men and boys who are doing the work. In many countries the milk of the ewe is used as an article of food; but it is usually manufactured into cheese.

The goat is raised in Switzerland for the purpose of furnishing milk to the peasants. Both the goat and the sheep can secure a good living where a cow or horse would not thrive at all. They can climb the mountainside easily, and feed on the scanty grass and leaves which grow on different kinds of shrubs. The domestic goat has often been called the poor man's cow; and this is very true, for those who can not afford to purchase a cow may be able to secure a goat.

For the little food which the goat eats, it gives in exchange an abundant supply of milk and a valuable growth of hair, which can be shorn once a year. The goat is a very trouble-

some creature about the home, for it eats up many useful articles, such as clothing, etc.

Sheep are very harmless creatures, and the lamb is a perfect picture of innocence. This animal was chosen by the Lord, on account of its disposition, to be a representative, in the sacrificial system, of the Christ who was to come. John, in calling the attention of his disciples to Christ, said, "Behold the Lamb of God, which taketh away the sin of the world." The prophet Isaiah, in speaking of the crucifixion scene, says of Christ: "He was oppressed, and He was afflicted, yet He opened not His mouth; He is brought as a lamb to the slaughter, and as a sheep before her shearers is dumb, so He openeth not His mouth."

While the sheep and the lamb are used as symbols of Christ, the enemies of Christ are symbolized by the wolf and the goat. Find texts of Scripture where the lamb, sheep, wolf, and goat are used as symbols.

References.—"Principles of True Science:" See Lamb. "Parts of His Ways," section 10, chapter 17. Zoology, see Ungulata, Ruminantia, and the animals mentioned in the lesson.

Questions and Suggestions.—What member of the hoofed family forms the subject of this lesson? What ones have we already studied? In what ways are the cow and horse useful to man? In what way is the sheep useful? What near relative of the domestic sheep is found in the Rocky Mountains? Compare its size and appearance with that of the domestic sheep. What other wild animals resemble the sheep? Compare the strength and endurance of the sheep with that of the goat, deer, etc. What would happen to the sheep were it not for the care and protection of man? Describe the two kinds of hair produced by the wild sheep. What is the hair of the domestic sheep called? Of what value is the wool of the sheep and the hair of the goat? By what means are the sheep shorn of their wool? What use is made of the milk from the sheep and goat? In what countries is it used? What is the goat sometimes called? Why? Where do goats usually obtain their food? Of what does it consist? Of what is the sheep and lamb a type, as spoken of in the Scriptures? What does John the Baptist call Christ? To what did the prophet Isaiah compare Christ as he saw the crucifixion scene in vision? What does the goat symbolize in the Scriptures? The wolf?

LESSON XXIV.

The Four-Handed Animals.

THE MONKEY.

We must not close the study of the land animals without noticing the interesting group called the four-handed animals. It includes the monkey, ape, gorilla, chimpanzee, orang-outang, etc. All these creatures live in tropical countries; indeed, it is with difficulty that they can live in the temperate regions. The principal home of the monkeys of the New World is Brazil. It is a land of perpetual summer, with dense, luxuriant forests, which abound with fruit, the favorite diet of the monkey.

The reason why this group is called four-handed animals is because they are able to use the four limbs as hands. Not only so, but their feet are formed like a man's hand, having four fingers and a thumb. The spider-monkey is sometimes said to have five hands, for it can use its tail as a hand to grasp a branch or another monkey's hand. It is called the "spider-monkey" because it looks like a spider going over its web, when, with hands, feet, and tail, it glides swiftly over the network of branches.

These monkeys sometimes make a "monkey-rope," reaching from the limb of a tree to the ground, by hanging by their tails, one beneath another. Another monkey living in South America is called the "howling monkey," for every time the sun rises and sets, this boisterous fellow begins to howl. Others take up the cry till often forty or fifty join in with it. These howlers are often caught, but it is impossible to tame them. South America contains the only monkeys which can use their tails for grasping.

The four-handed animals are most interesting creatures to watch. They are very curious, mischievous, playful, and

very skilful at mimicry. They perform some wonderful feats, about one of which I must tell you. Of their own bodies the monkeys can form a living bridge across chasms, gorges, and rivers, so that the mothers and children can pass over easily and quickly. This is the way it is done:—

Several of them run up a large tree near the edge of the stream; then one of them passes out on a strong limb, and, making several turns of its tail about it, slips off, and hangs with its head downward. Then a second one climbs down the body of the first, and fastens its tail about the neck and fore-limbs of the first. This is repeated until a long monkey-rope is formed. This living rope starts to swinging, slowly at first, but in a few minutes its lower end touches the branches of a tree on the opposite side. The end monkey grasps hold of these, and the bridge is perfected. Sometimes four or five hundred monkeys will pass over this living bridge.

The question now arises, How will the monkeys forming the bridge pass over? Should number one let go its tail, it, with several others, would be dashed against the opposite bank, or soused into the water. God has endowed these creatures with intelligence which helps them out of their seeming emergency. Several of the strongest monkeys throw their tails about the last monkey in the bridge, and run up to a strong, high limb, thus lifting the bridge into an almost horizontal position. This being done, a screaming signal is given by the last monkey to the first one forming the bridge, to let go of the limb; then the whole chain swings over. The lowermost animals drop to the ground, while the higher ones leap to the branches, and come down by the trunk.

References.—"Parts of His Ways," section 10, chapter 18. Zoology, see Quadrumana and the animals mentioned in the lesson.

Questions and Suggestions.—What animal do we consider in this lesson? To what family does it belong? Name other members of the four-handed family. Where do these creatures live? Why are they called four-handed animals? Compare their hands and feet with those of man. What organ of the body is used for climbing, besides

the hands and feet? Describe the "spider monkey." Why is it so called? How do these monkeys reach the ground from the end of a long limb? Describe the "howling monkey." Where does it live? Can the monkey be tamed? What is the general disposition of these four-handed creatures? How do monkeys cross chasms, gorges, and rivers? How do the children pass over? Describe the monkey bridge, telling how it is formed, from beginning to end. How many families of animals have we studied so far? What types have been studied under each family? Make a table showing the families studied, and the types under each family. What creature still remains for us to study which God created on the sixth day? Out of what did God make the land animals? The air animals? The plants?

LESSON XXV.

Animals as Symbols.

1. Have we found that the things of nature studied thus far are spoken of in the Scriptures? What use is made of them in the Bible? Give texts where light, heat, water, air, rocks, mountains, trees, flowers, clouds, dew, rain, sun, moon, and stars are used as symbols. What does each one symbolize?

2. Are the animals also used as symbols?

3. What animals can you name that are thus used? What does each one symbolize?

(1) The lion; it represents a kingdom. Dan. 7:4, 17.
(2) The bear also represents a kingdom. Verse 5.
(3) The leopard. Verse 6.
(4) The ram represents a kingdom. Dan. 8:3, 4.
(5) The goat represents a kingdom. Verses 5-8.
(6) The dragon represents paganism. Rev. 12:9-17.
(7) The beast of Revelation 13, having the characteristics of the leopard, lion, and bear, is a symbol of the Papacy. Rev. 13:1-10.
(8) The two-horned beast represents the United States. Rev. 13:11-18.
(9) The lamb as a symbol of Christ. John 1:29; Ex. 12:3-10.

(10) The goat, symbol of Satan and his followers. Matt. 25:31-46; Lev. 16:7-11.

(11) The dove, a type of Christ and a symbol of the Holy Spirit. John 1:32-34.

(12) The eagle represents Babylon and Egypt. Eze. 17:1-10.

4. Are nations now represented by symbols?

5. What animal represents the United States? Great Britain? Russia?

6. What is the idea in the minds of those who choose these animals to represent different nations?

7. Why did the Lord choose the animals He did to represent the different nations?

8. What characteristic of the lion makes it a fit symbol to represent Babylon? The bear to represent Medo-Persia? The leopard, Grecia? Why is the United States represented by a lamb-like animal with the voice of a dragon?

Suggestions to Teachers.—In this chapter we have attempted to call the minds of the pupils to the most familiar land animals, such as they have opportunity to observe and study day by day. We have studied these as types of families. We have also mentioned several members of each family which would naturally be taken up after obtaining a good knowledge of the common types. Probably you will not have opportunity to study more than a single type during the present year, but other members of the families may be taken up from year to year, as you come to the study of the same family of animals. In this lesson the students will study the symbolical use which the Lord makes in representing nations by animals, selecting such as will best represent the characters of the nations. We find that many of the nations even at the present time are commonly represented by certain animals. The eagle represents the United States; the lion, Great Britain; the bear, Russia.

Chapter XI.

MAN.

(Scripture Basis, Gen. 1:26-31.)

LESSON I.

Creation of Man.

The first thing toward bringing order out of chaos was the creation of light and heat. These forces changed the water to vapor. Then God created the atmosphere, which is His means of lifting the clouds from the earth. The work of the first two days was to construct a system whereby the water might be lifted up into the firmament. This being done, the Creator caused the dry land to appear, by gathering the waters together in one place.

The dry land was to form a home for man and the lower animals. Not only was it to provide for them a home, but it was to supply them with daily food. "And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind." In His wisdom God had already provided for the maintenance of plant life; for without light and heat, the plants could not live; and without water to nourish them, they would cease to grow.

After the Lord had planted the earth with vegetation, He placed permanent sources of light and heat in the heavens,—the sun, the moon, the stars. Even as the Lord provided light, heat, water, air, and soil, before He created plants, so He provided food before He created the animals which were to be sustained by it.

For the animals He created, He made three homes,—one in the water, one in the air, and one on the land.

After He had brought into existence the fishes of the sea, the fowls of the air, and the creatures which were to live on the dry land, He said: "Let Us make man in Our image, after Our likeness; and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. So God created man in His own image, in the image of God created He him; male and female created He them."

Man was the climax of God's created works on the earth. He was made a little lower than the angels, and was crowned with glory and honor. The holy pair were placed in Eden. They were surrounded with everything that was attractive. The name of the father of the human family was Adam, and the name of the mother was Eve. God placed them in the garden, not to spend their time in an idle way, but to dress the garden and to keep it.

Man was endowed with powers of mind which were far greater than any possessed by the lower orders of creation. He could study and think about the wisdom and power of God as revealed in His handiwork. He was holy and righteous in character; for man was made upright in the beginning. He was provided with a wonderful organism. David, in speaking of the human organism, said, "I will praise Thee; for I am fearfully and wonderfully made." Like the plants, man was formed from the dust of the ground; but the all-wise Creator endowed him with a body and a mind which were superior to anything that He had before created on the earth.

References.—"Principles of True Science:" See Adam, Man, and Physiology. "Parts of His Ways," section II, chapter I. Zoology, see Bimana and Primates.

Questions and Suggestions.—Out of what did the Lord build this world? What was its condition when first created? What was God's purpose in creating the earth? What agency was present to help in the work of creating and forming the earth? What was the first work which the Lord did to bring order out of chaos? What

did the light and heat do? What was created the second day? For what purpose did God create the air? What was perfected by the first two days' work? What was the first thing done on the third day? For what purpose was the dry land caused to appear? How many classes of plants did the Lord create? Will plants grow without light, heat, air, and water? After the Lord had planted the earth with vegetation, what did He then do? For what purpose did God make the sun and moon? For what purpose did God create the plants? How many classes of animals were created? How many homes were provided for them? What creature did God create on the sixth day who was more perfect than any of the animals previously created? Out of what did the Lord make man? What relation was he to sustain to the lower animals? To the angels? To God? What does David say of the human organism?

LESSON II.

Man's Relation to Light.

THE EYES.

We have already seen that light bears important relations to the air, the water, the plants, and the lower animals; it also has its relation to man. When God made light, on the first day of the week, He had in mind the man Adam, whom He was to create on the sixth day. The light was to be a means by which man could recognize the wonderful creations which God had made during the six days; so God made the eye, the window which allows light to pass into the human soul. Not only can we see, by means of the sense of sight, the objects that are about us, but "truly the light is sweet, and a pleasant thing it is for the eyes to behold the sun."

The eye is set in a socket, or bony cavity, thus being protected against accidents which might otherwise result from external objects striking it. The eye is surrounded with a dark coating, which absorbs the light; inside of this is a lighter coating; and inside of the second coating is a third, consisting of an expansion of the optic nerve. This third coating is called the retina. The part of the eye which first

admits light is a transparent, horny layer; and just inside of this is a watery fluid. Back of this fluid is a crystalline lens. Back of the lens is another fluid, which is glassy in appearance.

You will remember that in the study of light, we considered the lens,—the instrument used to magnify the fly and other objects. It is used in microscopes and telescopes for magnifying very small objects. The Creator has placed in the eye a lens made of living tissue, which focuses the light in the same way as does the glass lens in the microscope and telescope. You will remember that the object appears magnified when we look through the lens, because the rays of light are bent. As the rays of light pass into the eye, through the crystalline lens, they are brought to a focus on the retina. The image thus produced is carried through the optic nerve to the brain; and thus it is that we behold the objects about us.

By studying the eye, we see that the Lord constructed a lens before lenses were invented by man. I will now name the different parts of the eye, and you may see if you can make a drawing of them.

The rays of light enter the cornea, pass through the aqueous humor, pupil, crystalline lens, vitreous humor, and finally reach the retina. The cornea is somewhat rounding, and bends the rays even before they pass through the crystalline lens. The choroid coating of the eye is black, and allows no light to pass through it into the interior of the eye. The sclerotic coating is light in color, and forms a background upon which the retina is spread out in a very thin layer.

References.—"Parts of His Ways," section 11, chapter 2. Physiology, see Eyes.

Questions and Suggestions.—What relation does light sustain to the air? To water? To plants? Does it sustain any relation to the animals? To man? What part of the human body responds to the light? In what way is light of use to man? What does the wise man say about the blessing of light? Where in the body is the eye placed? How is it protected? How many coatings has the eye? Describe each one. Describe the part of the eye which first admits

the light. What is found just inside this horny layer? What is the small opening called which allows the light to pass into the crystalline lens? Have we studied the lens before? In what instruments is it used? For what purpose? Who, then, made the first lens? Out of what material was it made? Describe the path of a ray of light, from the time it enters the eye until it reaches the brain. Name all the parts of the eye through which it passes. Make a drawing of the eye.

LESSON III.

The Care of the Eyes.

We should be careful how we treat the eyes which the Lord has given us to use in obtaining a knowledge of His ways and works. The eyes are two precious gems, placed in a carefully-prepared case, so that they may be preserved in good order. The eyelids, by their continual movement, called winking, protect the eyes from small insects and dust. The eyelids are fringed with delicate hairs, called eyelashes, so that the slightest touch gives warning, and the eyelids close.

Tear-oil is constantly passing over the front of the eye, washing it clean and keeping it moist, while the eyelid wipes it off by forcing the fluid into a little drain-pipe, which carries it down into the nose. There are times when this fluid is secreted so rapidly that the pipe overflows, and the watery liquid passes over the eyelids and drops down upon the cheek. These drops are called tears; and when a person is in such a condition of mind that this overflow of tears is brought about, we say he is crying. But you know we always feel better after a cry; not only is the mind relieved, but the eyes are well oiled during the process.

The eye is a very delicate organ, and is easy to get out of order. The eye becomes very weak after certain sicknesses, such as scarlet fever and measles. A person should be very careful not to use his eyes in reading on recovering from sickness. The habit of reading while traveling on the cars or in

carriages is also very injurious to the eyes. It is a dangerous practise to read when reclining on a bed or lounge, as the book can not be held in a steady position. We should be very careful to avoid reading books or papers which have small type.

The direction from which the light comes is a very important matter, also. The light should not come from the front and shine directly into the eyes, but should fall upon the print from behind, from above, or from the side. After reading for some time, the eyes should be given a rest—even if for only a moment—by looking at some objects in the distance. A person should never read, write, sew, or use the eyes in any way when they tingle or smart. This is nature's way of telling us that our eyes need to have a rest.

The eyes should not be rubbed nor handled roughly, even when irritated by some foreign substance; but the sooner it is removed, the better, for serious damage might arise from having it remain long in the eye. If your eyes trouble you constantly, you should consult some good oculist, and have them properly treated.

It is quite a fad now for young people to wear eye-glasses. They think it looks dignified to bear about a pair of spectacles on their nose, and to have a silken cord lop down over the ear. In the majority of cases, spectacles are not needed at all, but a little common sense, which will enable them to use their eyes in a proper way.

As we study the eye and see how wonderfully it is constructed, we get a fresh glimpse of the wisdom of the Creator, and it should lead us to have a strong desire to preserve our eyes in the best possible condition, in order that we may use them to His glory.

References.—The same as in lesson 2.

Questions and Suggestions.—For what purpose did the Lord give us eyes? How should they be regarded by us? What is that part of the eye called which closes during sleep? What is the movement of the eyelid called? What is the purpose of this continual winking? What do we call the delicate hairs which fringe the eyelid? How

are the eyes kept moist and clean? What becomes of this fluid? When there is an overflow, and this watery liquid passes over the eyelids, what do we say that a person is doing? What is each drop called? What diseases leave the eye in a weak condition? What care should be exercised at such times? What influence has reading while traveling upon the eyes? What other rules can you give with reference to the care of the eyes while reading, writing, and sewing? How should smarting and tingling of the eyes be regarded? When should an oculist be consulted? What does a careful study of the eye reveal with reference to its Creator? Is there a text of Scripture which tells us that the Lord made the eye? Ps. 94:9. Is the eye used in the Bible as a symbol? Matt. 5:29, 38; 6:22, 23; Eph. 1:18. What does it symbolize?

LESSON IV.

Man's Relation to Heat.

Connected with the light of the sun are the rays of heat. It seems necessary to have light, but we shall find it equally necessary to have heat. Plants and animals could not exist were it not for the heat given to the earth by the sun. The beautiful spring weather, with its warm, sunshiny days, is a gift to us from the sun. But the Lord made the sun; therefore these days are really a gift from Him.

Not only are the rays of heat which come to us a great blessing, but the heat which is generated in the human body is necessary to our existence. If the temperature of the body is taken by placing a thermometer under the tongue, it will be found to be 98.4 degrees Fahrenheit, provided the person is enjoying good health. This temperature remains constant unless the body is affected by some disease. Should it rise above 98.4 degrees, we know the person has a fever. Should the temperature fall below 98.4 degrees, we are warned that something is the matter with the circulation.

In order that the temperature of the body be kept uniform, it is necessary to wear heavy clothing in winter and thin clothing in spring and summer. God has so constructed our bodies

that a little deviation from the normal temperature is liable to cause sickness and even death.

Now the question before us, and one which may seem hard to solve, is this: Where and how does the body get its heat? It does not get it directly from the sun; for in the winter we keep our bodies warm by the heat obtained by burning wood and coal. But where did the wood and coal get their heat? At the time of the flood, vast forests were covered with water and earth. While in this condition, these forests were changed into coal. The wood which we burn is obtained from trees. But how do wood and coal produce heat?

This is brought about by the union of the oxygen of the air with the wood and coal. The fire is started with a match, and the fire of the match is produced by friction. Precisely the same phenomena occurs in the human body. Food is taken into the body by the digestive organs; the oxygen of the air enters the body through the lungs; this oxygen unites with the small food particles which are in the blood, and the union thus formed produces heat.

References.—"Parts of His Ways," section 11, chapter 3. Physiology, see Animal Heat and Circulation of the Blood. "Healthful Living," chapter 27.

Questions and Suggestions.—What have we found in a previous lesson is always connected with the light of the sun? What experiment did we perform which proves this to be true? In what ways have we already found that heat is very useful? Can plants live without heat? Can animals? Which is the more important, light or heat? What makes it possible for us to have such beautiful spring weather, with its warm, sunshiny days? May heat be produced without coming directly from the sun? In what ways? What is the temperature of the body, as shown by the thermometer? What causes the heat in the body? Does the temperature of the body remain constant? What may cause it to rise? What is necessary in order that the temperature of our bodies may be kept the same in cold weather as in warm? How may the generation of heat in the body be simply illustrated? What is combustion? What is the fuel that is taken into the body? Where does the oxygen come in contact with the food? Where does the oxygen enter the body? Does it enter the nostrils alone, or in connection with some other element? What is the name of this element? What purpose does it serve?

LESSON V.

Man's Relation to Heat (Continued).

CIRCULATION OF THE BLOOD.

In order that heat may be evenly distributed throughout the whole body, the Lord has provided a system of circulation, which enables the blood to enter the remotest parts of the body. The heart is the center of this system. It is the great pump which forces the blood through the arteries and into the capillaries; and from these it returns through the veins to the heart. Before passing out again, it is carried to the lungs, where it receives a fresh supply of oxygen. Then, passing back to the heart, it is pumped again through the body. This is the wonderful plan that the Creator has provided for heating the body.

I suppose you have often heard persons say, "My hands are cold," or, "My feet are cold; I can not get them warm," and this, too, on a warm summer day. What is the trouble?—The circulatory system is out of order, and needs to be repaired. One of the best ways to do this is to take exercise. Often a lack of exercise will bring about this condition.

Are you familiar with the heart, the wonderful machine which forces the blood to every part of your body? It is pear-shaped, and is divided into four chambers, called auricles and ventricles. The two auricles are situated in the upper part of the heart, while the ventricles occupy the remaining portion. Let us follow the blood in its circulation through the body.

We will begin with the right auricle. The blood passes from the right auricle into the right ventricle. From there it is forced through the pulmonary arteries into the lungs; it passes through the lungs, becoming laden with oxygen, then through the pulmonary veins into the left auricle. From there

it passes into the left ventricle. It leaves the left ventricle through the great artery called the aorta, which divides into several branches.

Some of these carry the blood into the head and upper limbs, while others carry it downward, supplying the stomach, liver, pancreas, and other parts of the body, finally terminating in the lower limbs. It is brought back to the heart from these extremities by means of veins. Two large veins enter the right auricle, one coming from the upper portion of the body and one from the lower. The connections between the arteries and the veins are small, hair-like capillaries.

References.—The same as in lesson 4.

Questions and Suggestions.—How did we learn, in our last lesson, that heat is generated in the body? Where does the air enter the body? Where does the food enter? Where in the body does the oxygen of the air and the food unite? What means has the Lord provided whereby the heat may be evenly distributed throughout the body? What is the center of this circulatory system called? What is the work of the heart? How is the blood conducted from the heart throughout the body? How is it conducted from the different parts of the body back to the heart? What system of small ducts connects the arteries with the veins? How is the blood carried from the heart to the lungs and back again to the heart? Where in the body is the heart located? What is its general shape? Into how many chambers is it divided? What are these chambers called? Name and locate each. Trace the flow of blood from the right auricle throughout the body and back again to the starting-point. What is the color of the blood in the arteries? In the veins? What makes the difference in color? What is the name of the large artery through which the blood leaves the heart? What organs of the body are supplied with blood from one of the main branches of the aorta? What other branches have we? What parts of the body do they supply with fresh arterial blood? Why is it that so many people suffer from cold hands and feet, when the Creator has provided them with such a perfect means for heating the entire body? Make drawings representing the heart, with its four chambers, and the complete circulatory system, showing the arteries, capillaries, and veins.

LESSON VI.

Man's Relation to Heat (Concluded).

PROPER CLOTHING FOR MAN.

A thin and delicate skin is the only natural clothing we possess. Our first parents, in their innocence, did not wear clothing as we now do. It was not until after they had sinned that they knew they were naked. The first clothing worn by Adam and Eve was made of fig leaves. Before the fall of man, the weather was so mild, the temperature so even, that there was no necessity for the wearing of clothing. "The sinless pair wore no artificial garments; they were clothed with a covering of light and glory, such as the angels wear. So long as they lived in obedience to God, this robe of light continued to enshroud them."

We learned in a previous lesson that the body has a temperature of 98.4 degrees Fahrenheit when in a normal condition. In order to have health, the temperature of the body should remain constant; and a slight variation from this normal temperature may endanger the life of the individual. The temperature of the body is greater than that of the surrounding air; consequently heat from the body is constantly passing off into the atmosphere. One purpose of clothing is to prevent this heat escaping from the body too rapidly. When the bare skin is exposed, we lose heat very rapidly, and feel chilly and cold.

This is one reason for our wearing clothing. Another reason is that the direct rays of the sun in the summer would scorch and blister the skin. Again, the clothing saves the skin from being torn or hurt by accidents. It also serves to keep the body from being exposed to the rain and snow. The frequent changes of the weather, so common in this country, are a severe tax upon the human system, and clothing is the

principal means whereby our health may be protected. Woolen clothing is worn during the winter, while cotton clothing is usually worn during the summer.

Many times the change of clothing is made too early in the spring, and coughs and colds are a result. It is better to wait until the weather becomes fully settled before making a change from woolen to cotton clothing, or vice versa. Often pneumonia and quick consumption are brought about by not exercising proper care in the change of clothing.

Woolen clothing is warmer than cotton clothing, on account of its having a greater amount of air space among the woolen fibers. In other words, the air is imprisoned in the woolen clothing; and, as air is a poor conductor, it will not allow the heat to escape from the body. Cotton clothing does not imprison the air, consequently allows more heat to escape from the body. A good many years ago Job was asked this question, "Dost thou know how thy garments are warm?" Can you answer this question?

More clothing is placed upon the bed in winter, not for the purpose of keeping the cold out, but to keep the heat in; and you will notice that woolen blankets and comforters are used more in winter than in summer. Wet clothing should be changed as quickly as possible, and the body should be rubbed dry after taking a bath. Undergarments should be changed frequently and regularly, and the bedclothing should be exposed freely to the sunlight and air. Do not allow yourself to feel cold. Whenever you feel chilly, put on more clothing; if you can not do this, you should go into a warmer room, or exercise briskly for a few moments. A wise physician once said, "Only beggars and fools go cold, the former because they lack clothes, the latter because they do not know enough to wear them."

References.—"Parts of His Ways," section 11, chapter 4. Physiology, see Clothing. "Healthful Living," see Dress, pp. 118-121.

Questions and Suggestions.—What is the natural clothing of the body? Before Adam and Eve sinned, did they wear clothing as we do now? Who made the first clothing for Adam and Eve? Out of what was it made? Did they feel the need of it? Why? With what kind of clothing did the Lord provide them after they were driven from the garden? Gen. 3:21; "Principles of True Science," p. 268. What covering did they have before they sinned? Why do we need to wear clothing? What kind of clothing is worn during the winter? During the summer? What care should be exercised in changing our clothing? What results from too early a change? Why is woolen clothing warmer than cotton? Why is more clothing placed upon the bed in the winter? What should we do when our clothing becomes wet? How often should our undergarments be changed? Why? What should we do with bedclothing in order that it may remain in good, healthful condition? What should we do when our bodies feel cold or chilly? Do you believe what the physician said about fools and beggars?

LESSON VII.

Man's Relation to the Air.

THE NOSTRILS AND LUNGS.

While air is necessary to lift the vapors above the earth, and carry the clouds about, thus watering the dry land, it is also necessary for the growth and development of plants, the lower animals, and man. As soon as God had formed man, He breathed into his nostrils the breath of life, and he became a living soul. Many persons breathe as if they thought God breathed into man's mouth instead of his nostrils.

The nostrils are provided with air chambers, in which the air is warmed before it enters the lungs. The nose contains the olfactory nerves, which respond to the fragrant odors that are carried about in the air. After the air has passed through the nostrils, it enters the music-box (larynx), which is situated at the top of the windpipe (trachea). The larynx contains the vocal cords, which vibrate under the influence of the air as it passes between them. In this way we are able to express ourselves in conversation and in song.

The air passes on down through the trachea, which divides into two branches, called bronchial tubes. Both these tubes divide and subdivide again and again into smaller and smaller divisions, until we come to the microscopic air-cells of the lungs. The trachea, with the two bronchial tubes and their smaller branches, remind one of an inverted tree. The two lungs are enveloped in a sac called the pleura.

As the air is received into the lungs, they are inflated. The lung-cell walls are permeated with minute blood-vessels—the capillaries. These subtract the oxygen from the air, and give off, in return, carbon dioxid, which is exhaled from the lungs. The oxygen passes into the body by means of the blood, and takes up waste particles of carbon, and carries them out at each expiration of the air from the lungs.

Not only does the air force these wastes out of the body, which, if retained, would cause death in a short time, but it also enables us, through the sense of smell, to detect the presence of impurities in the outer air, and thus avoid breathing them into the lungs, to poison the blood.

The sense of smell is not only a protection against these dangers, but through it we also are able to enjoy the delicate perfumes of the flowers, the fragrance of the fields and meadows, and the savory odor of our foods. Smell is also an important element in taste. One who has lost the sense of smell is unable to distinguish and enjoy the flavor of many articles of food. This may be tested by holding the nostrils closed, and endeavoring to taste various kinds of food. Without this sense of smell, which is dependent upon the air we breathe, we should be deprived of many of the pleasures of life.

References.—"Principles of True Science:" See Air. "Parts of His Ways," section 11, chapter 5. Physiology, see Respiration, Nose, and Lungs. "Healthful Living," chapter 26.

Questions and Suggestions.—On what day did God create the air? For what purpose did He create it? What relation does it sustain to the clouds? To plants? What relation does it sustain to the lower

animals and to man? As soon as God had formed man, what did He do to make him a living being? Should we breathe air through the mouth or through the nostrils? Why is it better to breathe through the nostrils? What sense is located in the nostrils? What nerves connect the nostrils with the brain? Of what value is the sense of smell? After the air passes through the nostrils, where does it go? What is the name of the music-box located at the entrance of the windpipe? Describe the vocal cords. What causes them to vibrate? Describe the windpipe, or trachea. Into how many branches does it divide? What are these called? Describe the subdivisions of the bronchial tubes. What are the terminations of these small tubes called? What are the lungs? How many are there? In what way are the lungs protected? Where are the lungs situated in the body? What is the work of the lungs? What is thrown off from the lungs? Is the carbon dioxid of any value? What do the plants breathe? What do they throw off? Has the plant lungs? Where are they located? Make drawings representing the path which the air takes after entering the body at the nostrils. What do the lungs, with the trachea, resemble? By what means can we detect the carbon dioxid in the air? Describe a good system of ventilation. See lesson on Ventilation, in chapter 2.

LESSON VIII.

Man's Relation to the Air (Continued).

HOW TO BREATHE.

We have already learned something about the process of breathing, but there is much more to learn in order that we may breathe rightly. There are very few people in the world who know how to breathe correctly. What is breathing? Night and day, from the first moment of our existence until the last, we continue to breathe, without one minute's rest. We breathe even when we are not thinking about it. Breathing is the process through which the body goes in taking air into the lungs and sending it out again. The lungs should be well filled with air at each breath. Many persons breathe only in the upper part of the lungs, and the result is that the lower part, not being used, gradually becomes ineffective.

It is one of nature's laws that what we will not use, we can not have. Should we not use one of our arms for some

time, we should find that it would become weaker and weaker, and finally entirely useless. Notice the arm of the blacksmith; how large and strong it is! This is because of the work it does in swinging the hammer and in running the forge. The much-dreaded disease, consumption, is very likely to result from improper breathing.

It is an excellent plan to rise early in the morning and take a walk in the fresh, bracing atmosphere, filling our lungs as we walk, to their utmost capacity, and then slowly breathing the air out again. If you would have a rich, mellow voice, you must have a good pair of lungs behind it. The voice of a person having poor lungs has usually a thin, squeaky sound. We should be careful to breathe pure air at all times. Many persons are very careless in this respect, sleeping with their windows closed, breathing the air over and over many times. There is hardly a night, even during the cold winter months, but that the windows may be left open with perfect safety. One should be very careful, however, to avoid drafts of cold air, and should never allow these to fall directly upon the head.

A very good plan is to raise the lower window six inches or a foot, by placing a board just underneath the window which will entirely close the opening. The air will then come into the room between the window sashes, and the current will be directed upward instead of downward. There are many ways in which we may ventilate a room. You should study this question for yourself, and see which is the best way for the room in which you sleep. The nose very readily detects the impurities which may be in the air. This will be especially noticeable if you go out-of-doors for a few moments where you can breathe pure air, and then return again to the room. Carbon dioxid is the gas which poisons the air, rendering it unfit to breathe. It is heavier than air, and can be poured from one dish to another. In our next lesson we will study some ways of experimenting with this poisonous gas.

Questions and Suggestions.—What is breathing? What organs are connected with the breathing process? What special sense? Under what system does the study of proper breathing come? Do people generally breathe in the right way? What is wrong about their way of breathing? When the lungs are not filled with air, what happens to the lower portion? What is one of nature's important laws? Can you think of any instances which show this law to be true? (The moles have no eyes, because they do not use them; nor have the fish in Mammoth Cave. There are traces of eyes in both these animals, but they are very rudimentary.) What plan should we follow in order to have strong, healthy lungs? Does the voice depend upon the lungs? In what way? When are people most careless with reference to having pure air? Mention a good way to ventilate a sleeping-room. Should the window be open at the bottom or at the top? Why? Should there be a good circulation of air in sleeping-rooms in winter as well as in summer? What is the name of the gas which makes the air unfit to breathe? How does its weight compare with that of air?

LESSON IX.

Man's Relation to the Air (Continued).

EXPERIMENTS WITH CARBON DIOXID.

We have learned something with reference to the gas which makes the air unfit to breathe, but we desire in this lesson to perform a few experiments which will give you a still better acquaintance with it.

Experiment 1.—Breathe into a fruit-jar, or large-mouthed bottle, until you have filled it with carbon dioxid; now lower a lighted candle into the jar, and notice what happens to the flame. Why does the flame go out?

Experiment 2.—Have two clean fruit-jars in readiness to perform this experiment. In one of the jars place a table-spoonful of saleratus, or common soda. Pour upon the soda a tablespoonful of acetic acid or vinegar. What takes place in the jar on adding the vinegar? Now lower a lighted candle into the jar, as in the preceding experiment. What is the result? What does this prove? Now pour the gas from this jar into the other, going through the same motions you would

if you were pouring water. Do not allow any of the vinegar or soda to enter the second jar. Lower a lighted candle into this jar, also. What takes place? What does this prove with reference to the weight of the carbon dioxid?

Experiment 3.—Procure some limewater from your druggist. Blow through a straw or glass tube into the limewater, and notice what change takes place.

Why do persons, before going into a cistern, lower into it a lantern or light of some kind? Should the light not go out, would it be perfectly safe to enter the cistern? Should the light be extinguished, it would be very probable that carbon dioxid was present in the cistern. The question now arises how it came there. It is quite likely that when the cistern is cleaned out, some decaying animal or vegetable matter will be found. A chicken may have dropped into the cistern, or a cat may have fallen in and drowned, as is oftentimes the case. As the body decays, the carbon dioxid is formed.

Carbon dioxid is a product which results from the decay of all kinds of organic matter. If you open your coal stove in the winter, you will notice a peculiar odor, which is rather disagreeable to the smell. This is carbon dioxid. I will now relate an instance which I know to be true. A father and son built a cistern, and plastered it all over on the sides. When the cistern was completed, the young man placed at the bottom of it a kettle of coals. The next morning he arose early, and went down into the cistern to see how much the plastering had dried during the night. Two or three hours later the young man was found at the bottom of the cistern in an unconscious condition. Can you state the reason? This young man had attended school several years, and was to graduate the coming summer. He had studied physiology and chemistry. Was there any excuse for this accident happening to this young man? Would there be any excuse for such an accident happening to you after having studied this lesson?

Questions and Suggestions.—After performing the three experiments in this lesson, write out in your own language each experiment, with its results. Make drawings which will illustrate these three experiments. What is fire-damp? How does it compare with carbon dioxid? How may it be detected? Where is it usually found? Relate the incident given in this lesson, and account for the same.

LESSON X.

Man's Relation to the Air (Concluded).

THE HUMAN EAR.

In our last lesson we learned that air is very important, for without it man can not live. If you close the nostrils with your hand, you will soon see that you can live only a short time when deprived of air. You can live much longer when deprived of light, heat, water, or even food, than you can without air. The air is often spoken of in the Bible as the breath of life. We also learned that air is necessary in order that we may be able to speak. In the body the Lord has placed a very delicate instrument, which is played by the air as it passes down the trachea into the lungs, or on its return from the lungs into the atmosphere again.

Besides sustaining life and enabling us to speak, the air brings to man the sweet fragrance of the flowers, and also of his food, especially of such fruits as apples, strawberries, oranges, etc. But there is another way in which the air is very useful, and that is in the matter of hearing.

Hearing is almost entirely dependent upon the vibrations of the air. To understand this we must know something about the construction of the ear. The outer ear is simply a funnel leading into the canal which terminates with the ear-drum. This portion of the ear is sometimes called the external ear. The ear-drum forms a partition between the external ear and the middle ear. The middle ear is a cavity which contains a chain of three small bones; one end of this chain of bones

is attached to the ear-drum, while the other end connects with another cavity known as the inner ear. The inner ear is spiral-shaped, and is filled with a watery fluid. The walls of the inner ear are covered with very small hairs. In the fluid are very small granular bodies, called ear-stones. When the fluid is agitated, these little stones strike the small hairs with which the cavity is lined, and thus stimulate the nerves, which unite and form one large nerve which terminates in the brain.

So we really hear, as well as see and smell, in the brain. These nerves of sense are simply projections of the brain to different portions of the body. In other words, it is the brain reaching out its arms through openings made in its hard, bony covering, so that it may come in touch with the outside world. It may be likened unto a telegraph or telephone system which has one central office, and extending out from this are lines radiating in every direction. In the human body this is known as the nervous system.

You may ask, "How does the liquid in the inner ear become agitated?" This is done by the air vibrating against the ear-drum, and the movement is communicated by the three small ear-bones to the inner ear, which contains the watery fluid. The outer ear is so constructed that it collects the sound vibrations, and the middle ear carries these vibrations to the inner ear, from which they are transferred to the brain. I am sure that we shall appreciate the wonderful blessing God has given to us in the air, when we learn that without it we not only could not live, but neither could we speak, hear, or smell.

References.—"Parts of His Ways," section 11, chapter 7. Physiology, see Ear.

Questions and Suggestions.—How can you illustrate the absolute necessity of the air? Which is the most essential to man's existence, light, heat, air, or water? What is the air called in the Scriptures? Besides sustaining life, what else does the air enable us to do? How does it enable us to speak? To smell? What other important organ besides the nostrils and organs of speech responds to the influence of the air? Where is the ear located? What is the portion of the ear

outside of the body called? What is its general shape? Why is it so constructed? What partition lies at the end of the external opening of the ear? Describe the middle ear. How many bones does it contain? How are these bones situated in the middle ear? What is their function? With what part of the ear do these bones communicate? Describe the cavity of the inner ear. What does the cavity contain? With what is it lined? What is the work performed by the inner ear? What is the name of the nerve extending from the ear to the brain? Where, then, do we hear? To what may the brain, with its projections—such as the optic, olfactory, and auditory nerves—be compared? How is the brain projected? Enumerate the blessings that come to us through the air. Make drawings showing the ear, with its three divisions.

LESSON XI.

Man's Relation to Water.

In the last lessons we have studied, we spoke about the relation which man sustains to the things which surround him. You will remember that we studied man's relation to light, heat, and the atmosphere. In our study we learned that the blessings of sunlight, the sun's heat, and pure air, are absolutely essential to man's happiness. Not only are they necessary to happiness, but he could not live were he deprived entirely of any one of them. While they are so useful to man, they are also necessary for the lower animals and for the growth of plants. We study to-day man's relation to water.

Could we get along without water?—No; it is just as necessary as light, heat, and air. We could live for a short time without any one of these except air; but this we must have in our lungs every moment, to sustain life. There is not an instant when the lungs have not some air in them. A person could live for several days without water; but he would finally die. Plants will live for some time without water; but we have noticed that in a time of drought the leaves curl up and wither; and if it continues, they die.

In studying geography, we learn that three-fourths of the earth's surface is covered with water. The Creator causes the water in the seas and oceans to be lifted up by evaporation and carried over the land surface. As it drops down upon the earth in the form of rain, it develops what we call brooks, creeks, and rivers. These flowing streams empty into the ocean. Thus the water returns again to its original place. Water travels in a circuit.

This truth is told us by the wise man when he says, "All the rivers run into the sea; yet the sea is not full; unto the place from whence the rivers come, thence they return again." What is the purpose of the Creator in having the water travel in this circuit?—That the earth may be watered, so that it will bring forth vegetation. This vegetation constitutes the food for man and for the lower animals.

It is also necessary that water should be taken into the body in order that it may be kept in a healthy condition. What becomes of this water? Does it build up the body? If not, what is its use? Physiologists, who have studied the subject carefully, tell us that water is not a food, and does not change its form while in the body. As nearly as can be ascertained, the use of water in the body is to keep it cleansed and lubricated. Nearly three-fourths of the body consists of water. It enters into all the tissues and into the blood; in fact, it circulates through the entire body, carrying particles in it which are to be thrown off as waste matter.

Water is taken in at the mouth, but is thrown off at every point of the surface of the body.

References.—"Principles of True Science:" See Water. "Parts of His Ways," section 11, chapter 8. Physiology, see Excretory System. "Healthful Living," pp. 226-228.

Questions and Suggestions.—When was water first created? Gen. 1:1, 2. How much of the earth did it cover? How much does it cover at the present time? What means has God provided for watering the earth? Does water bear any relation to plants? What is it? How do plants take up moisture from the earth? Does water bear a direct relation to man's body? Where does water enter the body?

What is the desire for water called? Is water as necessary to man as light and heat? Which can a person live the longest without, water or food? What Bible writer tells us of God's method of bringing water out of the ocean to supply the necessities of man and the lower animals? Where is this text found? What becomes of water after it is taken into the body? Does it change its form? What is the purpose of water in the body? What proportion of the body consists of water? By what organs is the water eliminated from the body? In the Scriptures, what is water used to symbolize? Find five texts where it is so used. What is the thirst for water used to represent? Ps. 42:1.

LESSON XII.

Man's Relation to Water (Continued).

THE HUMAN SKIN.

If we carefully examine the human skin, we shall find that it contains many little glands, or ducts, for conveying the water to the surface. The water, when separated from the body by the process of sweating, or perspiring, is not pure, but is filled with poisonous matter which has been taken up by it while on its journey through the body.

We see, therefore, that one purpose of water is to keep the body well cleansed, so that each part may do its work without interruption.

The skin not only serves to eliminate waste matter from the body, but also gives us the sense of touch. Take a small magnifying-glass and examine with it the ends of your fingers or the palm of your hand, and notice the little ridges, called papillæ. Each one of these papillæ has in it a small nerve; this connects with larger nerves, which find their way to the brain. We can not insert a pin anywhere in the body without feeling pain. The reason for this is that the entire surface of the skin is permeated with these small nerve fibers.

Thus you see that the skin serves two purposes,—that of an excretory organ and that of an organ of touch and feeling. If we would have the sense of touch well developed,

and have the skin do its work of elimination properly, we must apply water to the outside of the body, thus keeping it thoroughly cleansed.

Water is also a valuable agent in restoring health. It is used by the skilled nurse, not only in the many different kinds of baths, but also in fomentations, compresses, rubs, pours, etc. That which is good for us when we are in health is the best thing to restore us when we are sick.

Let us see to it that we drink good, pure water; for impure water is the cause of many diseases. Is the water in your well pure? I will give you a simple test by which you can determine whether the water you are drinking is fit for use: Place the water to be tested in a small, clean bottle; add a pinch of sugar. Leave the bottle uncorked in a warm place. If the water appears cloudy within two days, it is not fit to drink.

References.—"Parts of His Ways," section 11, chapter 9. Physiology, see Skin and Kidneys. "Healthful Living," chapter 28.

Questions and Suggestions.—How is water eliminated from the body? What is this process of elimination called? Describe the small glands, or ducts of the skin. Can they be seen with the naked eye? Is the water which is separated from the body by perspiration as pure as it was when received into it? Why not? What does it contain? What is the great business, then, of water in the human system? If the body is cleansed by water on the inside, does it need cleansing on the outside? Give the reason for your answer. What other organs have we for eliminating wastes from the body, besides the skin?—The kidneys and urinary organs. Where are these organs located? How often should one take a bath in order to keep his body thoroughly cleansed? In what other ways is water valuable besides in cleansing the body? What are these simple treatments called? For what ailments are they administered? What other function does the skin perform besides that of eliminating wastes from the body? Examine the ends of your fingers, or the palm of the hand, with a magnifying-glass. What are these small projections called? With what is each one supplied which gives to us the sense of touch? How do the small nerves in the papillæ connect with the brain? Can we insert a fine needle anywhere in the body without touching one of these small nerves? In what part of the body is the sense of touch most keenly developed? How many of the special senses have we studied so far? Name them. To what system of the body do the five sense organs belong? Should we be careful as to the purity of the water we drink? Give a simple method for testing it.

LESSON XIII.

Man's Relation to the Dry Land.

We have seen in our study thus far that man bears a certain relationship to light, heat, air, and water; and in this lesson we shall consider him in his relation to the dry land, which appeared on the third day. Man has a very close relationship to the dry land, or soil, as it is often called. The dry land is also spoken of as earth, or ground.

We find in reading the record of man's creation that "the Lord God formed man of the dust of the ground." Not only was man formed from the dust of the earth, but "out of the ground the Lord God formed every beast of the field, and every fowl of the air." Not only were the animals created from the dust of the earth, but "out of the ground made the Lord God to grow every tree that is pleasant to the sight, and good for food."

In our study of the Dry Land (chapter 4) we learned something with reference to the composition of the earth. Thus far man has discovered about seventy elements, which go to make up all that we find in the animal, vegetable, and mineral kingdoms. Scientists who have given the composition of the human body careful study, have learned that it consists of nearly the same elements, and in the same proportion, as we find in good, fertile soil.

It seems very reasonable that this should be so; for that which God provided to sustain man's life and to build up his physical being was to come forth from the soil. In other words, the dead, inorganic elements of the soil are converted into living plant tissue, and in this way the soil is changed into food for man. The first change made is from the soil into plant tissue; the second change is from plant tissue into animal tissue. So when we see a plant, let us remember that

we are looking at soil which has been made alive, and that animals which live entirely upon plant food consist of plant life developed to a higher degree, and capable of moving about from place to place. This was God's original plan; but at the present day we find things very much changed.

Many animals do not subsist upon plants at all, but live entirely upon flesh food. Some live upon partly animal and partly vegetable diet. Man, the crowning work of God's creation, is found guilty of violating God's original plan. But there are a few who are adhering to God's order, and who find that it results in higher development of both the physical and the spiritual man. There are about fourteen elements found in the human body. The most common ones are oxygen, hydrogen, nitrogen, potassium, sodium, magnesium, calcium, phosphorus, and sulphur.

We read in the Scriptures that as a man thinketh, so is he. It is equally true that as a man eateth, so is he. When man dies, his body decays and returns to the original elements. This truth is stated in the Scripture when it says, "Dust thou art, and unto dust shalt thou return." The bones of the body are composed largely of mineral matter. They give to the body its shape and strength. As we study the framework of the body, and see how well it is constructed and fitted together, we shall find that it reveals to us the great wisdom of its Creator. The psalmist says, "He knoweth our frame; He remembereth that we are dust." Ps. 103:14.

References.—"Principles of True Science:" Man, Origin of, "Patriarchs and Prophets," pp. 44, 45. "Parts of His Ways," section 11, chapter 10. Physiology, see Composition of the Body.

Questions and Suggestions.—What relations have we learned that man sustains to light, heat, air, and water? Does man sustain a close relationship to the dry land? By what other names is the dry land spoken of in the Scriptures? Out of what did the Lord form man? What besides man was formed from the ground? Out of how many elements is the earth and all things therein composed? How many of these elements are found in good soil? How many elements are

found in the human body? How do they compare with those found in soil? Describe the transformations which take place in the soil to make it fit for food. How is vegetable tissue changed into animal tissue? Is God's original plan with reference to the transformation of soil into plants and from plants into animal tissue, being carried out at the present time? Name the common elements which enter into the composition of the body. What becomes of the body when it dies? What part of the body is composed largely of mineral matter? What is the purpose of the bones? Does the Creator understand the structure of the human frame? Ps. 103:10.

LESSON XIV.

Man's Relation to the Dry Land (Continued).

THE BONES.

The bones are the framework of the body. They are to the body what timbers are to a house, giving it strength and form. As we learned in our last lesson, the bones are composed largely of mineral matter. The bones in the living body do not look like the bleached, dry bones which we find after the body of an animal has decayed, but they are of a beautiful pink color, and are permeated with blood-vessels which convey the blood containing material for the growth of the bones. The bones are something more than a mere framework; they serve many useful purposes. For example, they protect the soft and delicate structures which lie beneath them, such as the brain, heart, and lungs. The upper portion of the head—sometimes called the brain case, or skull—is composed of eight bones tightly locked together at the seams, resembling what the carpenter calls "dovetailing." The bones surrounding the lungs and heart form a barrel-shaped cavity which protects these vital organs.

As we look at the human frame, we see that it is naturally divided into four parts. First, the head, which might be called the cupola of the body, having windows,—the eyes. Beside the eight bones forming the skull, there are fourteen

facial bones. Second, the trunk; this is the main portion of the skeleton. The principal bones of the trunk are the back-bone, the ribs, and the hip-bones. The back-bone is the main pillar of the building, and consists of a tapering pile of separate bones, one on top of another. The back-bone gives a graceful form to the body, unless it has been deformed by improper sitting, or other causes. The seats in many of our schoolhouses are so constructed that they deform the body and ruin the health. Between the bones of the spinal column are placed little cushions of cartilage. These help to break the force of any shock which may come to the body, just as the springs of a carriage lessen its jolting.

The ribs pass from the back-bone around to the front like the hoops of a barrel, and form the front wall, or chest. The last two ribs on each side are too short to reach the breast-bone, and are called floating ribs. The two hip-bones are the largest bones in the trunk. They might properly be called the sills of the house in which we live. Each of these bones contains a deep, cup-shaped cavity into which the round head of the thigh-bone fits. Third, the upper limbs, commonly called arms. These are two branches extending out from the upper portion of the trunk. They are fastened to the trunk by the shoulder-blade.

Each arm consists of three large bones and several smaller ones. The small bones are found at the extremity of the arm, and go to form the hand. Instead of the arm being one long bone reaching down to the hand, we find that it is jointed about half way down. This joint is called the elbow, and enables the hand to be used very freely. The bones of the wrist are crowded closely together like the stones of a pavement. They are held in place by strong, flexible bands, or cords. This also facilitates the movements of the hand, so that we can do almost anything, from the grasping of a heavy hammer to the threading of a fine needle. Fourth, the lower limbs, commonly called legs. These are attached to the lower

portion of the trunk, and are used in moving the body about from place to place. The extremities of the legs are constructed much the same as the hand.

References.—"Parts of His Ways," section 11, chapter 11. Physiology, see Osseous System and Bones.

Questions and Suggestions.—Of how many bones is the skull composed? How are they fitted together? What are the seams called where the edges of these bones unite? Into how many divisions is the human frame divided? What may we call the upper division of this house? Has it windows? How many bones form the skeleton of the face? What is the next division below the head called? Name the principal bones composing it. What is the purpose of the back-bone? Of what is it formed? How are these small bones united? Why is the back-bone curved? In what ways are we liable to deform the back-bone? Why are cushions of cartilage placed between the bones of the spinal column? To what are the ribs attached behind? In front? What do we call the front wall formed by the ribs? What are the lowest ribs called? Are they attached to the breast-bone? What are the largest bones in the trunk called? To what may we liken them, in the house in which we live? What is most noticeable on the external surface of these bones? Of what use is this cavity? What is the third division of the skeleton? To what are the arms attached? How many large bones compose each arm? Are there other bones in the arm? What do they form? Why is the arm jointed? What is this joint called? How are the bones of the wrist arranged? How are they held in place? Why are there so many small bones instead of one large one? Name the fourth division of the skeleton. To what are the legs attached? By what means are they attached? What is their use? In what respects are the arms and legs similar?

LESSON XV.

Man's Relation to the Dry Land (Concluded).

MORE ABOUT THE BONES.

The bones of the body are so constructed as to serve the purposes for which they were made. All the bones have not the same work to do. In a general way, the purpose of the bones is to give form to the body; but, as we have already learned, they do more than this: they protect the delicate portions of the body. When the great Master Mechanic

constructed the human temple, He used a great deal more wisdom than do men when they construct houses. He knew just what each part of the human building was to do, just how strong it should be made in order to do that work. So we see that the bones vary greatly in respect to size, shape, and structure. Some of the bones are large and hollow; others are short and thick; while others still are long and slender. The point where these bones come together, and move on each other, we call a joint.

The joints are bathed with a fluid something like the white of an egg, the common name for which is joint-oil. As we move about, the bones of the body are continually in motion, and this oil allows the rubbing surfaces to move smoothly on one another, thus avoiding friction. When we think of our own bodies, how they are so constructed that they will run themselves and keep the parts well oiled, we certainly must conclude that the Creator made a most wonderful machine. Man has not wisdom enough to produce anything like it.

The ends of the bones are different from the main body of the bone; they are composed of a white substance which is called gristle. Some of the joints are real hinges. At the elbow we have a hinge joint. All our fingers and toes have hinge joints. The most wonderful joints are called the ball-and-socket joints. There is one of the joints at the shoulder, where the head of the arm-bone fits into a cup in the shoulder-blade. This joint is used a great deal in the movements of the arm, as in turning a grindstone, or swinging a bat when playing ball. Another ball-and-socket joint is found where the leg is joined to the trunk of the body.

But the bones would not remain joined together were it not for the cords which have been provided to keep them in place. Some of these cords, called ligaments, are as narrow as a piece of tape, while others—like those at the sides of the knees, or at the shoulders—are quite wide. If we would have bodies which are erect and graceful in form we must

look after the health of our bones. The bones of young children are very easily bent, because they are soft and gristly. No doubt you have seen many grown people who are bow-legged. This deformity probably was caused by the carelessness of the father and mother, who allowed their child to walk when it was too young to support its body on its small, weak legs. In our next lesson we shall study those portions of the body which work the bones; these are called muscles.

References.—The same as in lesson 14.

Questions and Suggestions.—What did we learn about the purposes of bones in our last lesson? How do the bones differ in shape, size, and structure? Why? Mention some of the bones which are long and slender. Why were they so made? Mention some which are large and hollow. Why were they so constructed? Mention some bones that are short and thick; short, wide, and thin. What kind of work does each perform? What enables the bones to work upon each other without producing friction? Of what are the ends of bones composed? Name different kinds of bone-joints. What kind of joints have we in the fingers? Elbow? Shoulder? Thigh? Which joint allows the greatest freedom of movement? What holds the bones of the body together? Describe two different kinds of ligaments. What must we do if we would have erect and graceful forms? What causes people to be bow-legged? How may this be prevented? Procure a number of bones from the meat-market, and study them as to their size, shape, structure, joints, etc. Make a longitudinal section of one of the large bones of the arm or leg, by sawing it lengthwise. Make a cross-section by sawing a bone crosswise. Make drawings of both of these sections.

LESSON XVI.

The Bone-Movers.

THE MUSCLES.

In the last two lessons we have learned something about the bones which go to make up the framework of the body; but the human skeleton is not a beautiful thing to look at, although it is very useful. In order that the body might be

graceful and beautiful in form, the Lord has covered the bones with tissue called muscle. This muscular tissue causes the arms, face, and shoulders to look full and plump. Muscle tissue is usually called flesh. Muscle is the lean meat, which may be distinguished from fatty tissues by the color. It is red in color because filled with blood. Living skeletons are not desirable to look at, to say nothing about dead ones.

Probably you have heard persons remark of one who has suffered from disease, "He is but a walking skeleton." What do they mean by that?—Simply this: That the flesh, which is largely composed of muscular tissue, has wasted away under the influence of disease, so that the bones stick out. You will find a description of this condition of the body in Job 33:14-30. Besides giving a better form to the body, the muscles are useful in making its many movements. Our arms, legs, fingers, toes, mouth, eyes, and the great human pump called the heart, all these are moved by muscles.

There are nearly five hundred muscles in the human body. These vary greatly in size and shape. Some are very large, while others are quite small; some are shaped like a fan; others are long and round. The Creator manifested the same wisdom in constructing the muscles that He did in constructing the bones. They are so made that they may perform their appointed work in the best manner. The nature of muscles may be illustrated by a piece of India rubber. Take hold of each end of the piece of rubber, and pull it out longer, and you will see that it becomes thinner. When you let go, it springs back to its original shape.

Muscles have the ability to expand and contract, but they do not have to be pulled by some one else, as in the case of a piece of rubber. The muscles are attached to the bones by cords, called tendons. Let us illustrate the general action of the muscles by studying the movements of the forearm. The forearm swings upon the elbow, much as a door swings upon its hinges. The muscle which causes the arm to move

forward is located between the elbow and the shoulder; but it passes on down, and by means of its tendon, fastens itself to the bone of the forearm. When the muscle contracts, the forearm is brought forward. What enables one to straighten the arm out again?—There are muscles on the other side of the arm which contract, and bring the arm back to its original position. When the arm is flexed, one of the muscles contracts, while the other expands.

Most of the muscles of the body are arranged in pairs, which allows movement in two directions. The muscles are under the control of the nerves, which lead to the great nerve center, the brain; so that, when we wish to bend the arm, the finger, the leg, open or shut the eye, or the mouth, we simply have to will to do so, and we do it. When the body is paralyzed, or any part of it, then the nerves of that part have lost their control over the muscles. The bones of the body may very properly be called levers, while the muscles are the agencies which work them.

References.—"Parts of His Ways," section 11, chapter 12. Physiology, see Muscular System and Muscles. "Healthful Living," chapter 22.

Questions and Suggestions.—What purposes do the bones serve in the body? With what has the Lord covered the skeleton of the body? Of what does the muscular tissue consist? How may it be distinguished from fatty tissue? What gives the reddish color to the muscles? What purposes do the muscles serve? Mention parts of the body which are moved by muscles. How many muscles are there in the human body? How do these vary in size and shape? How may the nature and action of muscles be illustrated? What connects the muscles with the bones? Describe the movements and muscles of the forearm. Make a drawing of the forearm with its muscles. How are most of the muscles in the body arranged? Why? How are the muscles controlled? When a person loses control of the muscles, in what condition is his body? To what may the muscles and bones be compared? Have we any promise in the Word of God in reference to our bones?

LESSON XVII.

More about Muscles.

In our last lesson we learned something about the muscles, their shape, size, and something about the work they do. If you wish to study more carefully the structure of muscle, obtain a piece of lean meat from a butcher, tell him what you wish to do with it, and ask him to give you a muscle which has the sheath surrounding it. Boil this piece of flesh until it is well cooked, and then remove carefully the surrounding sheath.

You will find that inside of the muscle covering there are several bundles, each one having a covering similar to that of the entire muscle, only very much thinner. By working carefully, you will be able to take out entire bundles without injuring them. Now open one of these bundles, and you will find that it is composed of a number of threads, called muscle fibers. Should you examine these fibers with the microscope, you would find them to be made up of still smaller threads, called fibrils.

Why the muscles contract and expand we do not know. There are many mysteries in connection with our bodies which we shall have to leave unsolved; but we do know this, that it is the power of God which enables us to move about and to perform the work that we have to do. This was stated by Paul, when he said to the Athenians that God was not far from every one of us, for in Him we live and move and have our being. The muscles of the arms, hands, feet, and legs are very useful in performing work necessary for us to do in order to procure food and raiment and the common blessings of life. But many of the muscles are at work keeping the human machinery running, and keeping it well cleansed from the impurities which accumulate in the general

wear and tear of the tissues of the body. The heart has very strong muscles, which work ceaselessly night and day, whether we are awake or asleep. Strictly speaking, the heart obtains some rest between the different beats. The stomach is another organ of the body which is well supplied with muscles. It has three layers of muscles, each extending around the stomach in a different direction. These muscles give the stomach a sort of churning motion. When we move the hand, close the eyes, or shut the mouth, we first think about it, and do it afterward. But each time the heart beats, and each time we draw a breath, the action goes on without any special thought on our part. The muscles which act only when we think, are called the voluntary muscles; those which act without our thinking, are called involuntary muscles.

The muscles of the face are very interesting to study. You have seen some persons who always look pleasant, while others have a sour and morose expression. The face is a good index to the character of the individual. A person who has a sad, sour countenance, has been thinking sad, sour thoughts for a long time, and his feelings have been stamped on his face, where every one can see them. A person who has a bright, sweet, smiling face, has been thinking bright, sweet, pleasant thoughts, and he shows it in the expression which he wears on his face. This shows us the importance of being very careful as to the kind of thoughts we think; for the wise man has truly said, "As a man thinketh in his heart, so is he;" and that "a merry heart maketh a glad countenance."

References.—Same as in lesson 16.

Questions and Suggestions.—What did we learn about the muscles in our last lesson? How may we learn something about the structure of muscles? Describe the structure of a complete muscle. Draw a cross-section of muscle, showing the bundles and fibers. Why do the muscles contract and expand? Are there many mysteries in connection with the body? What does Paul say with reference to the origin of motion in our bodies? How do the muscles of the hands, feet, legs, etc., differ from those of the heart, lungs, and

stomach? How many coatings has the stomach? What are these coatings? What have they to do with the matter of digestion? What names are given to the muscles which act only when we think? To those which act without our thinking? What function have the muscles of the face which the other muscles of the body have not? Of what is the face an index? What does the wise man say upon this subject? Find the texts.

LESSON XVIII.

Proper Exercise.

The muscles are the working part of the body. They assist in all the various movements of the body, such as eating, drinking, walking, writing, and rowing, as well as in the work of such internal organs as the heart, lungs, and stomach. In order that the muscles may be in the best possible condition to do their work, they must be frequently exercised. You notice that the subject of our lesson for to-day is Proper Exercise. We wish to learn, if possible, how much exercise we must take in order that our bodies may be in the best possible condition.

Those who work out-of-doors, on the farm, usually have very strong and well-developed muscles. Those who are occupied in doing work which calls into activity the brain, rather than the muscles, have poorly-developed muscles unless they take regular exercise. Many boys and girls who spend their early years on a farm, afterward leave home and attend school. Here they give more time to study, and their physical being begins to weaken on account of not taking the proper amount of exercise.

It is not necessary that we should engage in some kind of play in order to have exercise; indeed, the very best exercise is found in doing work which will benefit either ourselves or some one else. Chopping, sawing wood, and running errands is much better exercise than playing ball or tennis.

In playing different kinds of games there is usually a desire to win, which causes overdoing. The players play so hard that they overtax their muscular powers, and the result is weakening, instead of strengthening, to the muscles. This spirit of competition may be brought into useful labor, but it is not apt to be.

Swimming is the best of all exercises; but it is not possible for every one to have the opportunity to swim. Next to swimming is walking, which takes us into the open air and the bright sunshine. But unless we walk in the right way it will do us little good. We should walk briskly, with the head up and the shoulders well back. The shoulders will be brought into a proper position by throwing the chest well forward.

When we take a walk, we should throw aside our cares and burdens, and allow our minds to dwell upon the varied scenes which nature presents to us. There are times when we should not exercise our bodies. One of these times is just after eating, for at this time the stomach is busily at work digesting the food, and this calls into action the muscles of the stomach. The blood also is called to the stomach to get a fresh supply of food material with which to build up the body. The evening is not a very good time to exercise, for then we are tired and need rest. We should be just as systematic in the taking of exercise as in taking our meals.

References.—Same as in lesson 16.

Questions and Suggestions.—What are the working parts of the body called? What must one do to keep his muscles in good condition for work? What class of people usually have well-developed muscles? Why do many young men and women come from college broken in health? What kind of exercise brings the greatest returns? Mention some forms of useful exercise. Why is the exercise connected with games harmful? What kind of exercise most nearly brings into play all the muscles of the body? What kind of exercise stands next to swimming? Why? How should we walk? At what times should we avoid taking exercise? How should our exercise be regulated? What two kinds of exercise are spoken of in the Scriptures? Which is the most important? 1 Tim. 4:7, 8.

LESSON XIX.

Man's Relation to Plants.

MAN'S FOOD.

Let us study for a while how the human body is related to the food which God has provided for man's use. We have learned, in a previous study, that the air is the food of the lungs, and that it enters the body at the nostrils. The food passes into the body through the mouth, a wonderful machine, composed of the lips, tongue, teeth, and palate.

This machine is a mill, in which the food is ground before it passes to other parts of the body. Some of the teeth are used in biting the food, and others in chewing and grinding it. The tongue gives us the sense of taste. While the food is being ground by the teeth, there are several streams of watery fluid, called saliva, flowing into the mouth. This not only moistens the food, but also partially digests it by changing the starchy portion into sugar. If you will chew a dry graham cracker for some time, you will notice that the longer you chew the sweeter it becomes. The saliva acts upon the starch, and changes it to sugar.

When the work is properly done in the mouth, the food passes down into a chamber called the pharynx; and if it were not for a trap-door covering the trachea, or windpipe, the food would go down into this, causing a coughing and a choking sensation. Many of us have experienced this when we have laughed while eating.

After passing the trachea, the food goes down into the esophagus, which leads to the stomach, the most wonderful machine in all the body. Here the food is churned very thoroughly by the contracting and dilating of the walls of the stomach. While this process is going on, the walls of the stomach secrete a fluid called gastric juice, which carries the

work of digestion still further. This juice acts upon the albumen, changing it into a milky fluid called chyme. When the food in the stomach is fully digested, it passes through a small opening called the pylorus, meaning "gate-keeper," which guards the opening at the lower part of the stomach. Here the food is further acted upon by the bile, which comes from the liver; by the pancreatic juice, coming from the pancreas; also by the intestinal juice, secreted by the walls of the intestines. When these three juices have acted upon the food sufficiently, it is taken into the blood by little ducts found in the walls of the intestines. These ducts unite with others, which carry the food particles throughout the whole system, and thus the entire body is nourished, and built up wherever it is in need of repair.

As we study the body the Lord has given us, we see that it is wonderfully constructed. No wonder David exclaimed, "I will praise Thee; for I am fearfully and wonderfully made."

References.—"Principles of True Science:" Plants Furnish Man's Food, "Spiritual Gifts," vol. 3, p. 76. "Parts of His Ways," section 11, chapter 13. Physiology, see Foods.

Questions and Suggestions.—What food has God provided for the lungs? What food has He provided to build up the body? At what place does the food enter the body? Of what is the mouth composed? What is the mouth sometimes called? What is the purpose of the teeth? What organ in the mouth is used for stirring the food? What sense resides in the tongue? How many senses have we studied so far? Name them. What moistens the food as it is being ground in the mouth? What action does the saliva have upon food? When the food is thoroughly masticated, what becomes of it? What would be the result if the food were not thoroughly chewed before passing on into the stomach? What keeps the food from dropping into the windpipe as it passes over it? Under what conditions might the food fall into the windpipe? Give the result. What connects the stomach with the mouth? Give the location of the stomach. Can you describe its shape? What work is done in the stomach? What fluid does the stomach secrete? How does the gastric juice act upon the food? When the food is thoroughly digested in the stomach, what is it called? Where does the food go from the stomach? What fluids act upon the food in the small intestines? Where are they secreted? What is the food called after being thoroughly digested in the small intestines? What becomes of the chyle? Do you think David told the truth in Ps. 139:14? Is the Lord acquainted with all the members of the body? Verses 15, 16.

LESSON XX.

The Digestive Machinery.

THE MOUTH.

In our last lesson we learned that the vegetable kingdom furnishes the food for man and the lower animals. This food is taken in at the mouth, which is a very wonderful part of the digestive system. In this lesson we shall study the mouth, and find out what it does with the food which is taken into it. It is the human mill which receives the food and grinds it so that it is in a condition to be received into the stomach. The stones used for grinding in this mill are called teeth. As the food is ground by the teeth, it is rolled around by the tongue.

During this time the food is well mixed with a fluid, called saliva, which flows from a number of little spongy organs, called salivary glands. Sometimes these glands become inflamed and grow quite large, producing what is called "mumps." The teeth of man resemble those of the animals which live upon vegetable food, such as the cow, the horse, and the monkey.

During our life we have two sets of teeth; the first set numbers twenty, and begins to appear when the child is about six months old. At the age of six, this set, usually called milk teeth, begins to decay, and a permanent set, thirty-two in number, gradually takes its place. Each tooth is firmly set in a socket in the jaw-bone, much as a post is set in a hole in the ground. The teeth are covered with a thin layer of a very hard substance, called enamel. The inside of each tooth is filled with a delicate substance, called pulp, which is well supplied with nerves and blood-vessels. If the enamel becomes broken or worn from the surface of the tooth, it

then begins to decay; and the nerves, being exposed to the air, soon begin to ache.

The saliva moistens the food and makes it much easier to swallow. The saliva does not flow very freely except while eating; the movements of the jaw seem to produce a free flow of saliva, even though nothing be taken into the mouth. Many times the odor, sight, or even the thought of food will stimulate a free flow of saliva. This may be illustrated by placing a mess of food out of reach of a cow.

Besides moistening the food, the saliva does another very important work: it acts on the starchy part of the food, changing it into sugar. Were it not for the saliva, the starch could not be dissolved; but when changed into sugar, it is readily dissolved, and can be easily taken up by the little ducts which convey the food throughout the body. When we are not eating, the saliva flows in small quantities, just enough to keep the mouth comfortably moist.

When the food is thoroughly masticated, it is ready to be swallowed. The soft mass is pushed into the back of the mouth, and forced down the food-pipe, called the esophagus, by a peculiar motion of the muscles. The food, in passing from the mouth to the stomach, passes over a trap-door called the epiglottis, and thus the food is kept from falling into the windpipe. In our next lesson we will study the stomach, and learn what we can about how it treats the food.

References.—"Parts of His Ways," section 11, chapter 14. Physiology, see Mouth, Teeth, Tongue, and Salivary Glands.

Questions and Suggestions.—Where is the food taken into the body? What is the purpose of the mouth? Of how many parts does it consist? What part does the grinding? While the food is being ground, how is it moistened? What is the cause of mumps? Do the teeth of man resemble those of the lower animals? Which ones? How many sets of teeth have we during our lifetime? How many in the first set? What are they called? How long do they last? How many in the second set? How are the teeth fastened in the mouth? With what thin substance are they covered? Describe the inner portion of the teeth. What results if the enamel becomes injured? What purposes does the saliva serve? What will stimulate a free flow of saliva? How does saliva act upon starch?

How may this be demonstrated? *Ans.*—By chewing a piece of bread, or cracker, which has not been sweetened. The longer you chew it, the sweeter it tastes. What becomes of the food after it has been thoroughly masticated in the mouth? What is the result if we swallow our food without chewing it thoroughly? What is the name of the tube which connects the stomach with the mouth? How does the food pass over the windpipe? How should we care for our teeth? *Ans.*—Cleanse them thoroughly just after each meal with precipitated chalk and water. Do not use the teeth to crack nuts. Why?

LESSON XXI.

The Digestive Machinery (Continued).

THE STOMACH.

In the previous lesson we studied the mouth, with its teeth and tongue, and noticed how they act upon the food, and with what results. We also learned how the food passes from the mouth over the windpipe, and down through the esophagus, finally reaching the stomach. The first part of our study was with reference to the grinding of the food, and the second was concerned with the swallowing of it. The act of swallowing transfers the food from the mouth to the stomach. In this lesson we shall take up the study of the stomach, and notice what further work is done by it on the food. The stomach is a pear-shaped bag, situated on the left side of the trunk, extending a very little below the lowest pair of ribs. You observe that it is placed where it can be protected by the ribs, the same as are the heart and lungs. The average stomach will hold about two quarts. The size of the stomach, however, depends upon how much there is in it; for its walls are capable of considerable expansion. The stomach has two openings, one where the gullet, or esophagus, connects with the stomach, and the other where the food passes out from the stomach into the small intestine. This latter opening is called the pylorus, which means the gate-keeper. It will not

allow any food to pass through it until it is properly digested. When there is no food in the stomach, its walls come together, just as in the case of a bag which has been emptied. But as soon as we begin to eat, the walls separate and make room for the food as fast as it enters. It also begins to move with a gentle, wavy motion, which carries the food round and round as if it were being churned. The motion is rather slow at first, but increases faster and faster as digestion goes on. In the walls of the stomach are thousands of little glands, which secrete a fluid called gastric juice. As soon as the food arrives in the stomach, these glands begin to pour out the gastric juice upon the food, which not only moistens it, but also digests a certain part of it. We have already learned that the saliva digests the starch by changing it to sugar. The gastric juice digests the albuminous part of the food, changing it to peptones. It is so called because of a peculiar substance contained in the gastric juice, called pepsin, which carries on this work. Perhaps you see now why many persons chew pepsin gum. It is supposed to contain this element, pepsin, and, when chewed, to aid in the work of digestion. If we look after the stomach as we ought, we will not need to resort to such means to help the stomach do its work. The white of an egg, the lean portion of meat, the gluten of flour, are examples of albumen. Some of the food of the stomach is sufficiently digested so that it passes at once into the blood, and helps to build up the body; but most of it passes on through the pylorus into the small intestine, to be acted upon by other juices. Could we look into the stomach when it is carrying on its work, we would see some very wonderful proceedings. The feeling of hunger which we experience is the word which the stomach sends to the brain, saying that it is in need of food to help build up and sustain the body. We should be careful that we put into our stomachs only such food as will make good material for building up the body.

References.—"Parts of His Ways," section 11, chapter 14. Physiology, see Stomach, Gastric Juice, and Chyme.

Questions and Suggestions.—What organs of digestion were studied in the previous lesson? Which one contains the sense called taste? Describe the teeth of a child; of an adult. How many teeth are in the first set? How many in the second? What work is performed by the mouth? What becomes of the food after it is thoroughly masticated? What is this act called? Where is the stomach located? What is its shape? Size? Describe the walls of the stomach. How many openings has it? Where are they situated? What are they called? What is the meaning of "pylorus"? Why so called? What is the condition of the stomach when it contains no food? What happens as soon as the food begins to enter the stomach? Describe the motions of the stomach. What fluid does the stomach furnish? What portion of the food does the gastric juice act upon? What is the result? Why do people chew pepsin gum? Is it necessary? Give examples of albumen. What happens to some of the digested food while in the stomach? What becomes of the undigested food? How should we treat our stomachs? Why?

LESSON XXII.

The Digestive Machinery (Concluded).

THE INTESTINES.

In the previous lesson we learned something about the work of the stomach. When the stomach has completed its work on the albuminous portion of the food, the gate-keeper opens the gate, and allows the partly-digested food to pass out into a long tube, known as the intestines, or bowels. The intestines are about thirty feet in length, and so packed away that they do not take up very much room. The first twenty-five feet are called the small intestine, and the remaining five feet the large intestine. The first foot of the small intestine is called the duodenum.

When the food enters this portion, it comes in contact with two fluids which flow into the duodenum through two little pipes. One of these fluids is of a greenish-yellow color, and is called bile. It is manufactured in the liver, and is sent to the duodenum to do a certain work upon the food. The other fluid, called the pancreatic juice, is made by the pancreas,

or sweet-bread, as it is often called in the lower animals. The small intestines also secrete a fluid, called the intestinal juice. These three digestive fluids,—bile, pancreatic juice, and intestinal juice,—do the last work in preparing the food to be taken up by the blood and lymph ducts, which convey the food to all portions of the body.

The liver is one of the most important organs of the body. It is the largest organ, and weighs from three to four pounds. It is on the opposite side of the body from the stomach. Its lower edge may be felt just below the ribs. As the liver makes the bile, it stores it up in a little pear-shaped bag, called the gall-bladder. The liver is a very busy organ; in fact, it does double duty: it makes the bile of the waste matter of the blood; moreover, it is a storehouse, and stores up a kind of sugar, which is gradually doled out to the blood as the body needs it.

The fat we eat—such as butter, cream, and nut products—is not digested in the mouth or stomach, but in the duodenum. The bile does this work by dividing the fat into very small pieces, so that it may be taken up by the blood. The pancreatic juice does a threefold work: it aids in digesting the fats, finishes digesting the starchy foods not already changed into sugar by the saliva, and also the albumen which the stomach has failed to digest. The intestinal juice changes the cane sugar into grape sugar, and is supposed by some to act upon the salts.

Now we have studied the action of all the digestive fluids upon the foods, and the next thing for us to learn is how the food is taken into the system to build it up. The digested food in the small intestine is called chyle. This is a thick, creamy mass, and looks very nutritious. The walls of the intestines are richly supplied with blood-vessels. Certain parts of the food readily soak through the delicate walls of these vessels, and so are taken directly into the blood. The walls of the intestines also contain millions of short, velvety threads,

called villi, which means tufts of hair. In each one of these villi is a network of the finest blood-vessels, and a tube, called a lacteal—meaning milky, because it carries a white, milky fluid. Millions of these lacteals dip down into the intestines like little root fibers, and suck up, like so many mouths, the fatty portions of the food.

References.—"Parts of His Ways," section 11, chapter 14. Physiology, see Intestines, Intestinal Juice, Pancreatic Juice, Bile, and Chyle.

Questions and Suggestions.—When the stomach has completed its work, what becomes of the partly-digested food, called chyme? How long are the intestines? Into how many sections are they divided? Give the length of each section. What is the first foot of the small intestine called? When the food enters the duodenum, with what two fluids does it come in contact? From what organs do they come? What is the color of the bile? Describe the liver, and give its location. What is a common name for pancreas? What fluid is secreted by the small intestine? How does the liver compare with other organs of the body in size and weight? What duty does it perform? Where is the bile stored away? What work does the bile do upon the food? How many kinds of food does the pancreatic juice digest? What is the work done by the intestinal juice? Through what two kinds of ducts is the food taken into the system? Describe the small blood-vessels, and the villi, with their lacteals.

LESSON XXIII.

How Food Is Digested.

We have given some study to the digestive system, and are acquainted with the different organs of digestion and their location. But we have given no thought as to how the different food juices act upon the food. We can illustrate this by a few simple experiments which will make the subject very plain to our minds. The first digestive fluid is the saliva. This turns the starchy portion of the food into sugar. This may be illustrated by the following experiment:—

Experiment 1.—Provide yourself with two or three small, well-cleaned bottles. (From your druggist you can obtain

some test-tubes, which are much better suited for experiments than are bottles. They cost but a few cents each, and can be used in other experiments also.) Take from the mouth a teaspoonful of saliva. Place this in one of the test-tubes. After thoroughly masticating a piece of cracker, mix it with the saliva. Add a little water, filling the test-tube about one-third full. Add a few drops of Fehling's solution, which is a test for sugar, and boil the contents of the tube over a small alcohol lamp. If your experiment works successfully, you will find that your solution has changed its color to that of orange red. Starch paste, as prepared for laundry purposes, is better than the cracker.

Experiment 2.—In this experiment we test the action of the gastric juice upon albumen. Place two or three pieces of the white of a boiled egg in a test-tube. Add to this a solution made from the scales of pepsin, which you may obtain from a druggist. Let it stand for twenty-four hours where the temperature is about 100 degrees Fahrenheit. This temperature can be made constant by placing the tubes in warm water. Prepare a second tube in the same way as the first; add to it a few drops of hydrochloric acid, and put it in a warm place. You will find, by carefully examining these two tubes after twenty-four hours, that in the first one no change has taken place; while in the second, the white of the egg has been partially digested. We learn from this experiment that gastric juice will act only in the presence of hydrochloric acid.

Experiment 3.—The pancreatic juice acts upon both the starch and the albumen. Obtain from the druggist a solution of the essence of pancreatin. Prepare two test-tubes, as in the above experiment, and use the pancreatin instead of the pepsin. In the second tube add a few drops of a solution of sodium carbonate. Place these two test-tubes in a warm place, as in the above experiment. You will find that the pancreatin will have no influence upon the albumen of the egg in the first

tube, while it will in the second. This shows that pancreatic juice will not digest albumen except in the presence of an alkali.

Experiment 4.—Add some of the pancreatin to a test-tube one-third full of olive-oil; shake thoroughly. Notice how the olive-oil is broken up into little globules of fat. This is the work of the pancreatic juice upon the fatty portion of our food. Try some of the olive-oil with water, and notice how quickly they separate.

Experiment 5.—Obtain some ox-gall from the butcher. Mix in a test-tube some of the ox-gall (bile) with some olive-oil. Shake thoroughly, and note the results. We see by this experiment that bile also emulsifies or breaks up the fats.

References.—"Parts of His Ways," section 11, chapter 14. Physiology, see Food Elements and Digestive Fluids. "Healthful Living," chapter 25.

Questions and Suggestions.—Perform these five experiments, and write out notes upon them, indicating the results. Name the different elements of food mentioned in this lesson. Name the digestive fluids. Name the organs of digestion, and give the location of each. What is the nature of the work done by each of these organs?

LESSON XXIV.

What Man Should Eat.

In our last lesson we learned how we should eat our food; but a matter of equal importance is to know what to eat. We have already learned that the vegetable kingdom should furnish man with food. We should endeavor, as far as possible, to conform to God's original plan in this respect. We find, by reading the Bible, that God did, in the past, permit His people to eat flesh food, but the people who live to be translated will be living on a diet which will be in harmony with a condition of things where sin does not exist. The wages of sin is death. Had sin never entered the world, no animal life

would ever have been sacrificed for food. It would seem as though we ought to be glad that we can find food which is wholesome and palatable, without destroying the life of the creatures which God has made to contribute to our comfort and happiness.

We will now consider some of the foods which are nutritious, and which can be easily obtained. Milk is the first food which sustains our bodies, and is probably one of the most perfect foods when in its pure condition. Milk is especially designed to nourish the body during the infant period. You will find by observing the lower animals that they do not eat the same food when full grown as when they are young. This is just as true in the case of man as of the lower animals.

In our study of the teeth we found that some of them were so constructed that the food might be ground before passing to the stomach. In early childhood the teeth are not adapted to chewing and grinding hard foods, therefore soft or liquid foods are a necessity. But because cattle are diseased, it is dangerous to use milk as a food.

Wheat flour is a very important article of food. It contains all the food elements necessary to sustain life, except fats. Fruits and grains, generally speaking, furnish the best diet for man. These can be used together without harm. Vegetables—such as potatoes, beets, and turnips—are inferior to the fruits and grains, but are much better than flesh food. While fruits and grains make a good combination, fruits and vegetables make a very poor one. We need not resort to animal food to obtain the necessary fats, for God has provided for this in the great variety of nuts, such as the hickory-nut, walnut, peanut, etc.

We should, then, not only be careful in selecting good foods, but should exercise great care in preparing them. The grains should be well cooked, for they are more easily digested. Frying food is the worst possible method of preparing it, since it can not then be so readily acted upon in the stomach, being

surrounded by a coating of fat. Hot foods, such as hot biscuit, are also very indigestible, especially when eaten with butter. But it is just as injurious to eat cold foods as hot foods. Food, in order to be easily and quickly digested, should not be eaten when much warmer than the temperature of the stomach.

References.—"Parts of His Ways," section 11, chapter 15. Physiology, see Foods. "Healthful Living," chapters 18-20.

Questions and Suggestions.—What was the original diet provided for man? Why should those who expect to be translated adopt this original bill of fare? What caused man to adopt flesh foods as a part of his diet? Mention some of the best foods that we find in the vegetable kingdom. What can you say of milk as a food? Of wheat? What is the best combination of vegetable foods? Name a poor combination. What part of the vegetable kingdom furnishes fats? What rule should we observe with reference to eating hot and cold foods?

LESSON XXV.

How to Eat.

After learning how food is digested in the body, it will be a good plan to learn how to do our part of the work of digestion. The processes which go on in the stomach are not under the control of the will, but there are certain things which we can control, and they should be looked after very carefully. To know just how to eat our food is a very important matter. In the first place, we should eat only wholesome food. The plainest and simplest foods are the best. When we are hungry, we will find that we will be satisfied with very plain food. If we eat when we are not hungry, we want foods which are highly seasoned, such as pies and cakes, in order to coax our appetite. We should avoid eating everything that we know is unwholesome. Because a thing tastes good is no reason that it is good.

As we have already learned, in the study of the mouth, the food must be thoroughly masticated before it is swallowed.

The more thoroughly this work is done in the mouth, the less will be required of the other organs of digestion. One should not take less than thirty minutes' time if he would eat his meals properly. He should eat his meals regularly. Many children have the habit of "piecing" between meals. Children are not so much to blame for this as are their parents. Have a regular time for meals, just as you have for work. You should not eat more than three meals a day, and those who are not engaged in hard physical labor can do very well with two meals. You should not eat just before going to bed; this will prevent your sleep being disturbed. You should not eat when very tired. It is better at such times to rest for a half hour before eating.

A very bad habit which a good many people have with reference to their eating, is that of drinking freely at meal-time. They wash down their food with cold and hot drinks. This weakens the saliva and the gastric juice, so that they do not do good work upon the foods. Ice-water also hinders the work of digestion. It lessens the temperature of the stomach, and the work of digestion is stopped for a time. In our lesson on experiments with foods, we found that the test-tubes must be placed where the temperature is about 100 degrees Fahrenheit.

Ice-cream has the same influence upon the stomach as ice-water; but it tastes good, and that is the reason that most people eat it. Many people live to eat, instead of eating to live. One very important rule we should observe in the matter of eating is this: We should not worry or fret while we are partaking of food. This takes the blood away from the stomach to the brain. We should be good-natured while eating, as well as at all other times. A hearty laugh and a merry heart make very good sauce. Prov. 15:13, 15; 17:22.

References.—The same as in lesson 24.

Questions and Suggestions.—How far can we control the processes of digestion which go on in the body? In what way can we exercise care in the matter of digestion? What kinds of food are

usually the most wholesome? What is a good test for hunger? What rule should govern in the matter of discriminating between good and bad foods? What is the first work that is done upon food when it enters the body? How much time should be taken for a single meal? How much care should be exercised in the matter of the time for meals? At what times should we not eat? Is it a good plan to drink while eating? Why are ice-water and ice-cream injurious? What should be the condition of our minds at meal-time? Why? What important rule should govern us in eating and drinking? On what point did Satan tempt our first parents? *Ans.*—The appetite. Gen. 3:1-7. What will be the condition in the last days? Luke 17:26, 27.

LESSON XXVI.

How to Combine Our Foods.

Physiologists tell us that there are three principal food elements which are specially required for the proper nourishment of the body. First, proteids, represented by albumen, gluten, fibrin, and casein. Albumen is found in the white of the egg; fibrin, in lean meat; casein, in the curd of milk; and gluten, in wheat. Peas, beans, lentils, and especially nuts, abound in the proteid element. Second, fats, found in very limited quantities in grains, but very abundant in nuts. Third, carbohydrates; this food element is represented by starch and sugar in their various forms.

These three food elements are found in combination in most foods, but vary greatly in their proportions. For example, grains contain starch and proteids, but very little sugar, and no fats; while fruits contain sugar, very little albumen, and no starch or fats. Nuts contain a large amount of proteids, about fifty per cent of fats, but very little sugar and starch. Legumes—peas and beans—contain a large amount of starch and a very large amount of proteids. Vegetables—like the potato, beet, and carrot—consist chiefly of starch, a very small amount of proteids, and no fats.

You see, therefore, from what has been said above, that no food contains all the food elements in the proper propor-

tion. Milk comes the nearest to this requirement, and wheat next. The three food elements are required in the following proportions: Proteids, seven parts; fats, three parts; carbohydrates, forty parts. Or, proteids, 2.8 ounces; fats, 1.2 ounces; carbohydrates, 16 ounces, making a total of twenty ounces per day. Should a person eat but two meals a day, he would use ten ounces at each meal; if three meals, six and two-thirds ounces per meal. Each of the food elements has its work to do in the body. The proteids are necessary for the building up of the blood, the muscles, and nerves. The fats and carbohydrates are necessary to maintain the heat and energy of the body. To obtain the three food elements in the proper proportion from the various foods which we may have at hand, is a very puzzling problem.

The first thing to be ascertained is how much of each food element is contained in each of the foods that go to make up the meal. In the second place, we must learn what quantity of each food must be used in order that we may have just the proper proportion of the food elements. We need not puzzle our brains over the first part of the problem, for the physiologist and chemist have furnished us with a table of the most common foods, showing the proportion of food elements contained in each article. The second part also has been worked out, with reference to an ordinary bill of fare. The author furnishes two of these bills of fare, that you may see about what would be the proper amount of food for a single meal, providing two meals a day be taken. Breakfast: Baked potatoes, 8 ounces; oatmeal, 3 ounces; graham bread, 6 ounces; cream gravy, 4 ounces; baked apple, 6 ounces; total, 27 ounces, or 1 pound 11 ounces. Dinner: Baked potatoes with lentil gravy (lentils, 2 ounces; potatoes, 8 ounces); graham crisps, 6 ounces; hominy, 2 ounces; canned grapes, 8 ounces; total, 1 pound 10 ounces. If three meals be eaten, only two-thirds of the amounts given in the above bill of fare should be used.

References.—The same as in lesson 24.

Questions and Suggestions.—Name the three principal food elements. Give familiar examples of each. In what proportion should they be used in our food? What is the work of the proteïd element in the body? Of the carbohydrates and fats? In what proportion are these food elements found in grains? Fruits? Nuts? Legumes? Vegetables? Study the bills of fare. What quantity of food is required daily?

LESSON XXVII.

The Five Senses.

In the study of man's relation to light, we learned of the sense of sight, which is located in the eye. But the eye is at the end of a projectoin of the brain called the optic nerve. Through this sense we see the objects that are about us, and become acquainted with their size, shape, and color. We must remember that it is not the eye which sees, but the brain, or mind, which is behind it. A certain portion of the brain is set apart for this work, and enjoys the sensation that comes from beholding the beauties in nature which are manifested through its variety of forms and colors.

In studying man's relation to the air, we discovered two senses,—those of hearing and smell. The sense of smell is located in the nostrils. These are lined with a thick, velvety membrane, over which the nerves of smell are distributed. This membrane is kept soft by a fluid which it secretes. When we take cold in the head, the membrane becomes dry and swollen, and the sense of smell is lessened. The sense of smell varies very much in different individuals. Many animals are more highly endowed with this sense than man. The dog can detect the smell of its master's footsteps amid those of hundreds of other people, and can follow him for miles, even though he has been out of sight for several hours. The sense of smell is nature's sentinel to guard against the use of improper food and the breathing of impure air.

The sense of hearing is also dependent upon the air, for where there is no air there is no sound. Sound is received by the organs of hearing, the ears, one being located in each side of the head. The sense of hearing is probably one of the most important of the five senses, and is usually counted next to that of sight. We could get along without being able to smell or to taste, but it would be very difficult to get along without being able to see or to hear. The ear is a very delicate organ, and should be very carefully treated. The ears of children should not be pulled and boxed, for many times such rude treatment results in deafness.

Children should not put beans or foreign substances into their ears. They should never use ear-picks, the ends of pencils, pins, hairpins, toothpicks, or anything else to scratch the ear canal; it is a foolish and needless as well as dangerous practise. Nature has provided for the cleaning of the ears, and will attend to it herself if we will leave it for her to do. Of course the ears should be cleansed with water, as well as the face; but the canal of the ear is so constructed that the ear wax will gradually drop out of the ear when it is no longer needed.

In studying the relation of man to water, we learned of the sense of touch, which resides in the skin. The skin is full of little pores, which allow the water to pass through them in the form of perspiration; but certain portions of the skin surface are ridged, and these ridges are made up of successive elevations called papillæ. They are well supplied with nerves. The palm of the hand and the fingers have these in great abundance. This sense of touch can be cultivated to a marvelous degree, as is shown by what blind people can do. They read rapidly by running their fingers over slightly-raised letters, and recognize their friends by feeling of their faces.

The sense of taste was discovered in our study of the relation of man to plants, which constitute his food. The food

which is received into the mouth is tasted by the tongue. If the taste is agreeable, the food is accepted, and passes on to the teeth, which begin the work of preparing it for its journey in the body. The tongue is covered with papillæ, much as are the hands and the fingers. In some animals these papillæ are very large, and make the tongue quite rough.

These five senses are important. They are the avenues through which we gain our knowledge of the world and the things that are in it.

References.—"Parts of His Ways," section 11, chapter 16. Physiology, see the Five Senses and the Nervous System. "Healthful Living," chapter 29.

Questions and Suggestions.—What sense did we study when considering man's relation to light? Of what value is this sense? What two senses did we discover in studying man's relation to the air? In what two organs do these senses reside? Describe the nostrils. Describe the ear. What care should be exercised with reference to the ear? What sense did we study in considering man's relation to water? Where is this sense located? What illustrates the marvelous degree to which these senses may be trained? Describe the papillæ of the hand and fingers. What sense did we study in considering man's relation to plants? Where is it located? With what is the surface of the tongue covered? Which one of the five senses is the most important?

LESSON XXVIII.

The Human Telegraph System.

We will name the seven systems of the body, and see what each one embraces. In the study of the five senses, we considered a portion of the nervous system; for we studied the large nerves which enable us to come in touch with the world in which we live. In the study of heat, we became acquainted with the circulatory system, God's means of distributing heat throughout the entire body. In the study of water we considered the excretory system. The principal organs of this system are the skin and kidneys.

In our study of man's relation to the soil, we learned that the bones are composed largely of mineral matter, and the study of bones introduces us to the osseous system. In studying the means which God has supplied for moving the bones of the body in walking, in handling objects with our hands, in chewing our food, etc., we became familiar with the muscular system.

In studying man's relation to the air, we gave attention to the nostrils and the lungs. These are organs belonging to the respiratory system. Last of all we studied man's relation to plants, which constitute his food. We studied the mouth, with its teeth and tongue; the epiglottis, esophagus, stomach, and the intestines. All of these are organs of the digestive system. Thus, you see, by this review, that we have been studying the body under seven divisions, or systems. We will name these systems again, and ask you to commit them to memory: (1) Nervous system; (2) circulatory system; (3) respiratory system; (4) excretory system; (5) osseous system; (6) muscular system; (7) digestive system. Although the body consists of so many different systems, they all work together in perfect harmony.

Each of the organs of the body works for the common good of all the other organs. If you strike suddenly at the eye, the lids close to protect it. The muscles of the eye cause the lids to shut. If you tickle the foot, the muscles of the leg will pull it away. And so we might go through the entire structure of the body, and find that there is a general sympathy and cooperation of all the parts.

The nervous system is that part of the body which has complete control over all the other parts. It is a complete telegraphic system. The brain is the main office, and the thousands of nerve fibers branching off in all directions to all parts of the body, are the telegraph wires. Dispatches are being sent constantly to the brain to tell it what is going on in various

parts of the body, and the brain, on receiving the news, sends back its orders as to what must be done; and the order passes through the nerves faster than it is possible for us to think. Should you put your hand accidentally on a hot stove, you would pull it away quickly, for the message is flashed along the nerves of your hand to the brain, and the brain at once sends a return message to the muscles, saying, "Pull the hand away." Do we not see more and more, as we study our bodies, that they are "fearfully and wonderfully made"?

References.—The same as in lesson 27.

Questions and Suggestions.—How many systems of the body have we considered so far in our study? Have we learned all about these systems? In what time of the world's history are we living? What does the prophet Daniel say of this time? Does the progress made in the study of the structure of the body agree with this statement? Name the seven systems of the body. What does the study of the five senses embrace? In considering the subject of heat, what system did we study? In considering water, what system? In our study of man's relation to the soil, what did we learn about the bones? To what system does this introduce us? By what means are the bones of the body moved? What organs were studied in connection with man's relation to the air? To plants? Name the organs of the digestive system. What digestive fluid acts upon the food in the mouth? In the stomach? In the small intestine? What fluids digest starch? Albumen? Fat? What occurs if you strike at the eye suddenly? What does this demonstrate? If you tickle the foot, what occurs? What system has control over all the other systems? To what is this system compared? Where is the main office located? What corresponds to wires? What is sent out from, and received by, the central office? How rapidly do these dispatches pass over the nerves? Give an illustration. What did a study of the mechanism of the human body cause David to exclaim?

LESSON XXIX.

What Is Health?

We often hear remarks like these, "I do not have very good health," or, "My health is very good." What is meant by "health" as used in the above expressions? The state of our health depends upon the condition of the body, and the con-

dition of the body depends upon how we treat it. It depends not only upon the external conditions and surroundings, but also upon the effect of those things which are received into the body.

We have found in our study of man, thus far, that he sustains certain relations to light, heat, air, water, soil, and plants. With these things he is constantly surrounded; he can not get away from them; he can not live without them. But he can not live by them unless he uses them in the way the Creator designed. The body may become overheated, as in the case of sunstroke. The air may blow upon the body in such a way as to produce a cold. The water which comes in contact with the body when one has been exposed to rain, will bring on rheumatism unless the clothing be removed. Vegetable food, unless of the right kind, properly cooked and thoroughly masticated, will produce indigestion or dyspepsia. But when a person suffers from the ailments above mentioned, he does not have good health.

It is plain, then, that if we would have health we must constantly maintain the proper relationship to the things by which we are surrounded. The study of physiology is designed to lead us to a better understanding of these relationships, and it is not a study simply of bones, muscles, and nerves. It is not to fill our minds with a lot of names which are hard to pronounce and almost impossible to remember; but it is to learn, in a practical way, how to appreciate the body which God has given us, and to learn the laws which govern it. In doing this, we shall learn the names of the different parts of the body, and shall easily remember them because of the real practical value of this study to our every-day life.

You will find by reading the laws which the Lord gave to the children of Israel, that they relate to the sanitary conditions of their homes, as well as to their religious life. They were to keep their bodies scrupulously clean, and their houses

free from filth. These bodies which God has given to us are the temples of the Holy Ghost. Should we not then regard it as a privilege, as well as a duty, to keep them in the best possible condition? The beloved disciple, John, in writing to the church, expresses this wish: "Beloved, I wish above all things that thou mayest prosper and be in health, even as thy soul prospereth."

References.—"Parts of His Ways," section 11, chapter 17. "Healthful Living," chapters 2 and 9.

Questions and Suggestions.—What expressions do we often hear persons make with reference to their health? What is referred to here by the word "health"? Upon what does our health depend? What things have we studied which bear certain relations to man? In what ways is man affected by these things? Mention several ways in which man may sustain a wrong relation to these things, and note the results. What, then, would you say is a proper definition of health? What is the study of physiology? What is it very apt to be? Should the names of the various parts of the body be learned? Did the Lord give to Israel laws which were to govern them in the matter of health? What were some of these regulations? What name does Paul give to our bodies, in Rom. 6:19, 20? When the beloved John wrote to the church, what wish did he express?

LESSON XXX.

Physical and Spiritual Health.

Let us read again the text found in 3 John, verse 2: "Beloved, I wish above all things that thou mayest prosper and be in health, even as thy soul prospereth." By reading this scripture carefully you will see that John expresses the desire that the prosperity of the body should equal that of the soul. In other words, John means that there should be health of both body and soul.

Some seem to have the idea that the time to be religious and spiritually minded is when we are sick. But this is not true. When one is suffering from a severe headache, dyspepsia, or some other ailment, he is easily irritated, and liable to think

and say things which he would not if the body were free from pain. Moreover, he can not give his entire thought to spiritual things when the body is suffering, any more than he can to physical things. A man can not do a good day's work for himself, or for any one else, if he is suffering from rheumatism or gout; neither can he do a good day's work for the Lord in spiritual service if his mind is dwelling constantly upon the pains and aches of his body.

Physical exercise is not as important as spiritual exercise. Paul tells this in 1 Tim. 4:8: "For bodily exercise profiteth little; but godliness is profitable unto all things, having promise of the life that now is, and of that which is to come." We are to exercise the body; but, as he says in the seventh verse, "Exercise thyself rather unto godliness." The reading of these scriptures would seem to indicate that we must look carefully after the matter of both physical and spiritual health; also, that spiritual health is very largely dependent upon physical health. It is equally true that if we would prosper physically, we must be spiritually minded, and engage actively and earnestly in Christian work.

Christian labor is a good medicine for bodily ailments. This truth is affirmed by Isaiah, fifty-eighth chapter, verses 6-8: "Is not this the fast that I have chosen? to loose the bands of wickedness, to undo the heavy burdens, and to let the oppressed go free, and that ye break every yoke? Is it not to deal thy bread to the hungry, and that thou bring the poor that are cast out to thy house? when thou seest the naked, that thou cover him; and that thou hide not thyself from thine own flesh? Then shall thy light break forth as the morning, and thine health shall spring forth speedily; and thy righteousness shall go before thee; the glory of the Lord shall be thy rearward."

We should not desire good health only that we may please ourselves, but rather that we may be able to render better service to the Lord. The apostle Paul expresses this thought

in Rom. 12:1: "I beseech you therefore, brethren, by the mercies of God, that ye present your bodies a living sacrifice, holy, acceptable unto God, which is your reasonable service." Let us then eat, drink, exercise our muscles, keep our bodies clean,—in a word, take good care of our physical being, that we may be able to glorify our Maker. "Whether therefore ye eat, or drink, or whatsoever ye do, do all to the glory of God." 1 Cor. 10:31.

References.—The same as in lesson 29.

Questions and Suggestions.—What do we learn from a careful study of 3 John 2? What wrong idea have some of the best time to be religious? Show that this is not true by some simple illustration. What does Paul say about physical and spiritual exercise? Which is the most important? What is the true relation between spiritual and physical health? What does Isaiah recommend as a good medicine for physical ailments? Why should we desire to have good health? What does Paul entreat us to do? In eating, drinking, exercising, what is the one great purpose which we should have constantly in mind? What scripture indicates this?

LESSON XXXI.

Disease and Its Causes.

Disease is the result of the violation of laws which God has given to govern our bodies. Many think that Providence is the cause of disease, but this is not true; for God does not delight in causing His children to suffer. Disease comes in consequence of not sustaining the right relation to the things which surround us. When these violations of God's laws are constantly repeated, disease becomes fastened upon the body, and very often results in premature death. Disease oftentimes is inherited from our parents, but if the children are properly trained, they may often overcome diseases thus inherited. The laws which govern our being are God's laws as really as are the ten commandments, and if we violate them, we are sinning against God. The Lord is very good to us, not

leaving us in ignorance as to how we should treat our diseased bodies.

We find that the very blessings which are so beneficial to us in health, are the agents which we should use to restore the body when diseased. When we learn that we have been exposed to disease, or when we observe its symptoms gaining ground, we should not give up in discouragement; but we should use energetically the means which God has provided for our recovery. I will mention a few of the more common causes of disease. First, heredity. This has already been spoken of, and is one which we can not easily avoid; but we can, if we are persistent and energetic, overcome even inherited weaknesses. Second, impure air. Living in close, poorly-ventilated rooms checks the circulation, and causes the blood to move sluggishly through the body. The mind becomes depressed and gloomy, and diseases of different kinds are very easily contracted. Third, imperfect breathing. The internal organs of the body—the stomach, liver, lungs, and brain—suffer if we do not take full, deep inspirations of air. Fourth, indoor life. Close confinement indoors will cause persons to become pale and feeble. They should be out in the pure air and bright sunshine. Fifth, overeating. Eating too frequently and in too large quantities overworks the digestive system, and is liable to produce a feverish condition of the body. Sixth, improper diet. Poorly-cooked food is one great cause of indigestion. A free use of sugar tends to clog the system, and frequently causes disease. A great amount of milk and sugar irritates the digestive organs and affects the brain. Flesh foods, especially, increase the liability to disease. Stimulants of any kind lessen the ability of the body to resist disease. Tea and coffee are used very generally, and are doing their fearful work of lessening the vitality of the system. Seventh, improper clothing. More die as a result of following fashion than from all other causes. Eighth, exposure to cold. When the body is exposed to cold, there is dan-

ger of contracting disease, especially if the body be weary and exhausted. Ninth, damp rooms. Rooms which are not daily exposed to sunlight and air are dangerous to sleep in. Tenth, drugs. Drugs enfeeble the system, and make it more susceptible to disease. Many other causes might be mentioned, but these are the more common.

References.—"Principles of True Science:" See Animal Food and Animals Diseased, "Spiritual Gifts," vol. 4, pp. 76, 120, 121, 146, 148. "Healthful Living," chapter 14.

Questions and Suggestions.—What is disease? Do we sin if we transgress physical laws? Why? Mention some of the common causes of disease. Find scriptures which show that the Lord is willing to heal our diseases.

LESSON XXXII.

How to Resist Disease.

In the last lesson we ascertained some of the most common causes of disease. To-day we will learn how we may resist the attacks of disease. Some persons contract disease much more readily than others. One who has overtaxed the system by hard physical or mental labor, usually succumbs to disease very readily, while those who are strong and robust may be exposed to the same disease without contracting it.

The power of the human system to resist disease is very great. If we would but live in conformity to the laws which God has implanted in our being, our health would be insured. Following are some of the most valuable means at one's command for resisting disease. First, the power of the will. Many readily succumb to disease because they have no heart to resist it. They yield to their feelings, and soon are prostrated. Second, temperance. By being temperate in labor, in eating and drinking, we can preserve health to a wonderful degree. Third, nourishment. The body must have sufficient nourishment. Good food, taken at proper times, will do much

to keep the body in a healthy condition. Fourth, sleep. Sleep is the means which God has provided for restoring the vigor and strength of the body. We need sleep as positively as we need food. The average person requires eight hours of sleep. Fifth, exercise. Both the faculties of the mind and the muscles of the body need to be exercised in order to be developed properly and to retain vigorous health. Sixth, bathing. Bathing frees the skin from the accumulation of impurities which are constantly collecting, and keeps the skin moist and supple, thereby increasing and equalizing the circulation. Some have the idea that a bath is necessary only for those who are sick. This is not true; it is absolutely necessary in order to keep well. On no account should we neglect regular bathing at least twice a week. A cold bath, taken every morning upon rising, has a very beneficial effect upon the system. Seventh, clothing. In order that the blood may circulate freely throughout the body, there should be an equal distribution of clothing, bringing equal warmth to every part of the body. Whatever part of the body is exposed will become chilled, and will drive the blood from the surface. Through carelessness in clothing the body, colds are taken, which often terminate in diseases and death. Eighth, unselfish work. By engaging in lines of missionary work, our minds are diverted from our own troubles and trials, and placed upon those who are in need of help and sympathy. Not only do we help others, but we are benefited because we do not find time to brood over our own weaknesses. All these methods of resisting disease are within the reach of every one. In a word, the best way to resist disease is to develop and maintain a strong, robust physical constitution.

References.—"Parts of His Ways," section 11, chapter 18. "Healthful Living," chapter 15.

Questions and Suggestions.—Name the causes of disease mentioned in our last lesson. When are persons most liable to contract disease? Mention some of the more common ways in which we may resist disease, giving the influence of each. Briefly stated, what is the best way for resisting disease? Who is the author of disease? Can you give an example in the Scriptures where Satan brought sickness upon an individual?

LESSON XXXIII.

How to Restore Health.

What shall we do when we are ill? This is a very important question, and should be studied carefully in order that we may act intelligently. Nature is the great restorer; she can build up the body and repair injuries which are the result of inattention to her fixed laws. When nature attempts to relieve the body of the poisons and impurities it may contain, this effort produces fevers; thus we may know if we are suffering from fever that nature is trying to do a favor by working to eliminate poisons from the body.

But what is nature?—It is the name given to the works of God which surround us, and to the manifestations of His power in the things which He has created. Hence, we see that God Himself is working to restore the health which man has lost either through ignorance or through a lack of cooperation with his Maker. It is an encouraging fact that God treats us mercifully in spite of our careless and heedless ways. We may assist nature in her efforts to restore health, by removing the causes of disease.

There are many ways of treating the sick, but there is only one way which God approves. His remedies are the simple agencies of nature, which do not tax or weaken the system. Pure air and water, the fresh sunlight, a proper diet, purity of life, and a firm trust in God are the remedies which God has given to us to restore our diseased bodies. When one is ill he should eat less than when well. It is a good plan to fast for one or two meals, and drink only pure, soft water. The loss of a meal or two will enable the overburdened system to get rid of the poisons which are lodged in it, and the free use of pure water will cleanse the tissues of their impurities. The patient should be kept free from excitement, and from depress-

ing influences. The attendants upon those who are ill should be cheerful and hopeful. This will have an inspiring influence upon the patient.

The condition of the mind has much to do with the health of the body. There are thousands who are sick and dying, who might get well if only they were able to control their will and their imagination. They think they are worse than they really are. They should exercise the power of the will, rise above their bodily aches and pains, and engage in some light but useful employment which will cause them to forget that they have aching backs, sides, lungs, and heads. A cheerful spirit and a contented mind are medicine for both body and soul. Nothing will aggravate disease more than a spirit of depression, gloominess, and sadness. "Godliness with contentment is great gain." 1 Tim. 6:6; Prov. 15:22.

References.—"Parts of His Ways," section 11, chapter 19. "Healthful Living," chapter 34.

Questions and Suggestions.—What is the most important thing for us to know when we are sick? How can we find out? Who is the great restorer? When nature attempts to relieve the body of poisons and impurities, what is produced? What is nature? Who, then, is the great restorer, after all? How may we assist nature in her efforts to restore health? What remedies has God provided for restoring the sick? Are these within the reach of the poor as well as the rich? What about our eating and drinking when we are sick? What should be the condition of the mind? What influence have cheerfulness and contentment upon the body? What does Paul say about contentment? Where is this statement found?

LESSON XXXIV.

Care of the Sick-Room.

It is very important not only to know how to care for the sick, but how to keep the room which contains the patient in the best possible condition. Even small children should learn how to do this, so that they may, with skilful hands and willing hearts, save many weary steps for older people. The sick-

room ought to be the lightest, sweetest, and most pleasant room in the house. All unnecessary furniture should be removed from the room, for it absorbs the impurities, and helps to keep the room in a foul condition. The room should be open to the sunlight and to the fresh air.

No one needs pure, fresh air so much as one who is ill. There should be constant circulation of air in the room, but it should be admitted in such a way that the patient will not be exposed to drafts. A clean, bare floor, with a few rugs to deaden the sound of footsteps, is better than a carpet. The patient should not be annoyed by the noise of children playing. Do not allow a kerosene light with its flame turned down to burn during the night. It makes an offensive odor. The sick-room should be kept neat and trim.

Everything that tends to irritate the patient should be taken from the room. In many diseases, especially in scarlet fever, diphtheria, consumption, etc., use old pieces of linen instead of handkerchiefs, and burn them as soon as they are used. Carelessness or ignorance in this matter often spreads contagious diseases. The clothing of the patient, as well as the bed-clothes, should be changed frequently. Such clothing should not be put away in the closet with other clothes. All foods should be kept out of the room, except at meal-time, unless it be an orange or lemon. A bouquet of a few favorite flowers will tend to make the room more pleasant.

Attendants should never go behind the door or into an adjoining room and whisper. Whatever must be said should be said openly and aloud. A pleasant room without a pleasant nurse is not as good as a pleasant nurse without a pleasant room. You see, therefore, the greatest responsibility after all rests upon the nurse, and that she should do all she can to make it pleasant and agreeable for her patient. She should be neat and tidy in her dress; she should speak pleasantly, and yet firmly. She should know what she is to do, and do it as one who is master of the situation. This will inspire confidence on the part of the patient.

References.—"Healthful Living," pp. 71, 155-160, 249-251.

Questions and Suggestions.—What sort of room should the sick be placed in? Should there be much furniture in the room? Why? Should the curtains be kept drawn and the windows tightly closed? What about letting drafts of cold air strike the patient? Should the floor be carpeted? In what condition should the sick-room be kept? Is it wise to use handkerchiefs for a patient suffering with a contagious disease? What would you do with the soiled clothing? Is it well to let food which is to be eaten stand in the sick-room? May flowers be placed in the room? Should they be changed frequently? Why is it well to speak so that the patient can hear what is being said when conversing in the sick-room? Which is more important, a pleasant room or a pleasant nurse? Are good nurses in demand? Why?

LESSON XXXV.

Accidents and Emergencies.

Accidents and emergencies happen every day. When they do, it is necessary to think and act on a moment's notice. A friend may cut himself with an axe or a knife; a boy may accidentally swallow some poison; a child may fall into the river; a neighbor may be nearly suffocated with coal gas, or have burned his body severely. A thousand and one things might happen of a similar nature. But what shall be done when they occur? A cool head, a steady hand, and the exact knowledge of what to do is required, in order that we may be master of the situation. We should become familiar with a few of the simplest helps, and learn how to apply them practically. The following are some of the more common accidents and how they should be treated:—

Fainting.—When a person faints, he should be laid on the back at once, with the head very low. Give plenty of fresh air, and dash cold water on the head and neck if necessary. Loosen all the tight clothing.

Suffocation.—The first thing to do is to give the patient fresh air. Remove the patient to the open air, and loosen all the tight clothing. Dash on cold water, and, if necessary, use artificial respiration, as described in the next lesson, on drowning.

Burns or Scalds.—Remove the clothing with the greatest care. Do not pull but carefully cut and coax the clothes away from the burnt places. Save the skin unbroken if possible, taking care not to break the blisters. The air should be kept from the burns and scalds as far as possible. Baking soda, used dry or dissolved in water, is a very good remedy for burns. To soak strips of old linen in a mixture of half linseed-oil, and half lime-water, is also a good remedy. To the burnt parts apply bandages, lint, or wads of absorbent cotton, so as to keep away the air.

Nose-bleed.—Keep the head erect, place a basin under the chin for the blood to run into, and then the patient should take several deep inspirations, filling the chest full at each breath. In most cases this will stop the bleeding. Ice may be applied to the nose.

Sunstroke.—The main thing to do is to lower the temperature. Remove the clothing from the body. Apply to the head chopped ice, wrapped in flannel. Rub ice over the chest, and place pieces under the arm-pits and at the sides. If there is no ice, use cloths wet with cold water. The body may be partially disrobed and sprinkled with ice-water.

Stings.—If a piece of the sting remains in the flesh, extract it with the fingers or with a pair of tweezers. Apply diluted ammonia water; after which, a cloth moistened with sweet-oil, cocoa oil, or cosmoline, should be placed upon the part.

Frost-bite.—The ears, the toes, the nose, and the fingers are occasionally frost-bitten or frozen. Rub the affected parts with snow or with snow or ice-water in a cold room. The circulation should be restored very slowly. Hot milk or other hot drinks should be given freely as stimulants.

Foreign Bodies in Eye, Ear, Nose, or Throat.—Children are apt to push marbles, beans, peas, or other small objects, into the nose. Get the child to help by blowing his nose hard. A sharp slap between the shoulders may cause the substance to fall out. Stop the well nostril, and blow suddenly and forcibly through

the mouth. Call in medical aid at once if you do not meet with success, especially if it is a pea or bean, which is apt to swell with the warmth and moisture.

If an insect crawls into the ear, drop in a little sweet-oil or molasses, gently raising the tip of the ear to cause the fluid to run in more readily. Wash out the substance by syringing with a little warm water.

Bits of food lodged in the throat may be removed easily by the forefinger, or by sharp slaps on the back.

Cinders, particles of dust, etc., may often be removed from the eye with the twisted corner of a handkerchief carefully used. Do not rub the eye. The upper lid may be turned back, and the substance thus found and removed, but this requires skilled help.

References.—"Parts of His Ways," section 11, chapter 20. Physiology, see Accidents and Emergencies.

LESSON XXXVI.

Accidents and Emergencies (Continued).

Drowning.—Remove tight clothing from neck, chest, and waist. Remove froth and mucus from the mouth by means of a handkerchief wrapped around the forefinger. Draw the tongue forward. Turn the body quickly on the face, raising it a little with the hands under the hips, to allow water to run out of the air-passages. Turn the person on his back, placing a coat or blanket under the shoulders to raise them a little. Remove wet clothing, substituting dry blankets, overcoats, etc. Apply heat to the limbs and feet. Be sure to keep up artificial respiration until natural breathing is restored. The simplest way to do this is as follows: Lay the person on his back. Kneel behind the head, grasp both arms near the elbows, and sweep them upward above the head until they nearly touch.

Make a firm pull toward you while you count three. This tends to fill the lungs with air by drawing the ribs up, and making the chest cavity larger. Now return the arms to the sides of the body, pressing them firmly against the ribs. This forces out the air, and makes, artificially, a complete act of respiration. Repeat this act fifteen times every minute, for several hours. As soon as the person can breathe, he can swallow. Give hot lemonade, a teaspoonful at a time, every few minutes. Keep up artificial warmth by means of bottles of hot water, hot flat-irons, sand, or bricks heated in an oven. Do not move a person from one place to another who is just beginning to breathe again, except when forced to do so from cold or necessity.

Bleeding of Arteries and Veins.—Blood from an artery is of a bright scarlet color, and spurts in a stream. Blood from a vein is of a dark purple color, and oozes out slowly or flows in a steady stream. When an artery is bleeding, make deep pressure between the wound and the heart. Send at once for the doctor. A firm grip in the right place with the fingers will do until a twisted handkerchief, stout cord, shoestring, or suspender is ready to take its place. Make a knot in the bandage, and bring the pressure of the knot to bear on the artery. If the flow of blood does not stop or decrease, change the pressure until the right spot is found. Flour, dry earth, or strips of underclothing may be crowded into the wound and firmly held in place. Learn the location and course of the principal blood-vessels of the arm, hand, leg, and foot, so that you will be able to apply pressure intelligently in accidents of this kind.

Bruises and Cuts.—A bruise is a wound of the soft parts caused by blows. Soak the injured part at first in cloths wrung out of cold water. Very hot water is often used to relieve the pain. For small cuts, clean the parts, bring the edges together and stick them with plaster, or hold the edges together with a strip of cloth bandaged about the part. Wounds caused by broken glass, rusty nails, pistol shots, etc.,

usually require the services of a doctor. Such wounds, if neglected, often lead to blood-poisoning.

Broken Bones.—Send for a surgeon at once. In the meantime bind the injured limb with handkerchiefs, suspenders, or strips of clothing, to a piece of board, pasteboard, or bark, padded with moss or grass. This will serve as a temporary splint. Be careful and tender in handling broken limbs. Bandage temporarily in this way before moving the patient. With as little delay as possible, get a surgeon to set the broken limb. Keep the patient warm. Do not give a drop of alcoholic liquor in emergencies of any kind.

Poisons.—Label poisons with the word "poison" plainly written in large letters across the label. Fasten the cork in the bottle by a wire twisted into a knot at the top. Put poisons under lock and key, out of the reach of children. Do not use the contents of any package or bottle unless you know exactly what it is. Do not guess at it; destroy it if you do not know. When poisons have been taken in spite of these precautions, the stomach must be emptied as soon as possible. Give the patient a quart of strong soapsuds, a cupful at a time. Run the finger or a feather "down the throat" to hasten the vomiting.

References.—The same as in lesson 35.

LESSON XXXVII.

How to Take Care of the Premises.

We have been studying the structure of our bodies, and how to care for them both in sickness and in health. We can do much to keep our bodies in good condition by keeping the premises just right. Oftentimes diphtheria or scarlet fever comes into a home, and the inmates wonder how this was possible.

If they will go down cellar they will soon learn the cause of it. There are vegetables, such as potatoes, turnips, and beets, in a decaying condition. A cellar in this condition is a very favorable place for the growth of disease germs. This process of decay is most likely to occur in the early spring when the weather becomes warm. The inmates should see to it that all decaying vegetables are removed from the cellar when spring approaches. In order to keep the cellar in the best possible condition, it should be so constructed that it can be thoroughly purified from time to time.

If you will go into the back yard, you will see another source of disease. All the waste material from the kitchen is thrown upon the ground just a few feet from the back door. This pile of refuse is not so dangerous in the winter when the weather is cold; but in the early spring, when the weather becomes mild, the process of decay and putrefaction goes on, and these germs thrive and increase rapidly. Instead of throwing waste material into the back yard, a box or barrel should be provided in which to place it, and the contents of this receptacle should be removed daily to a place where there will be no danger from it.

The well, too, is often a source of disease. Water from the barn-yard or the cesspool soaks down into the ground, and works its way into the well, thus infecting the water. This may be avoided if the cesspool and barn-yard are situated in some place where the ground is lower than that occupied by the well, so that its surface slopes away from the well instead of toward it. The entire premises should be kept in a sweet and clean condition the year around. Disorderly surroundings are an index of an indolent and slothful man. If, in passing a farm, you find the fences broken down and the tools scattered about the place, you may be sure that the owner is loose in his morals as well as in his farming.

Solomon describes such a man in Prov. 24:30-34: "I went by the field of the slothful, and by the vineyard of the man

void of understanding; and, lo, it was all grown over with thorns, and nettles had covered the face thereof, and the stone wall thereof was broken down. Then I saw, and considered it well; I looked upon it, and received instruction. Yet a little sleep, a little slumber, a little folding of the hands to sleep; so shall thy poverty come as one that traveleth; and thy want as an armed man." Let us do all we can to make our homes, both inside and out, pleasant and inviting, and give no place to disease by our carelessness.

References.—"Parts of His Ways," section 11, chapter 21. "Healthful Living," chapter 24.

Questions and Suggestions.—Through what avenue does disease often find its way into a home? When is this state of affairs most likely to occur? Should we regard the cellar as a sort of garbage box, and allow decaying vegetables to accumulate therein, or should we give to it the same care and attention as to the rest of the house? Why is the cellar a favorable place for the growth and increase of disease germs? What provision should be made for waste material? Name another common source of disease. How may contamination of the well be avoided?

LESSON XXXVIII.

Man's Relation to the Animals.

We have already noticed the relation of man to the vegetable kingdom. We found that the Lord created the plants for two purposes; first, for food for the lower animals; second, for man to look upon and enjoy. In our study to-day we will consider man's relation to the animals. Speaking to His Son, God said, "Let us make man in our image, after our likeness." He also indicated what was to be man's position in the great work of creation. These are His words, as found in Gen. 1:26: "And God said, Let us make man in our image, after our likeness; and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth."

So man was constituted the head of the animal kingdom, to have rule and dominion over all the creatures which God had created on the fifth and sixth days of creation. Everything was made for man, and he was to bear a certain relation not only to the animals but also to plants. The intellectual powers of man were so well developed that he was capable of appreciating the things which God had made; and, in return for these blessings, he was to render grateful praise to his Creator.

The lower animals sustain a different relationship to God, for they were not endowed with powers of reason, so that they could think upon God's creation, and express their appreciation in an intelligent way. Man was made responsible to God for the manner in which he improved the opportunities and privileges afforded him, while the animal creation was held responsible only for the service rendered to man, who was made its immediate ruler.

David brings out this relation of the lower animals to man in the eighth psalm, where he says: "What is man, that Thou art mindful of him? and the son of man, that Thou visitest him? For Thou hast made him a little lower than the angels, and hast crowned him with glory and honor. Thou madest him to have dominion over the works of Thy hands; Thou hast put all things under his feet; all sheep and oxen, yea, and the beasts of the field; the fowl of the air, and the fish of the sea, and whatsoever passeth through the paths of the seas." Verses 4-9.

The relation existing between man and the lower animals is also clearly brought out in the following words: "He was placed, as God's representative, over the lower orders of beings. They can not understand or acknowledge the sovereignty of God, yet they were made capable of loving and serving man. . . . Man was to bear God's image, both in outward resemblance and in character. . . . His nature was

in harmony with the will of God. His mind was capable of comprehending divine things."—P. P., p. 45.

At the present time we find that this relationship which God designed should exist between man and the animals has been broken, and that many of the animals are estranged from man. Many of them are his enemies instead of being his friends. Not only is this antagonism seen between man and the lower animals, but it is also manifested between man and man. In a future lesson we shall learn what brought about this condition of things; but it is easy to see from the texts already quoted, that God made the lower animals to be servants to man, and to express their love and affection for him in many ways of humble service.

In return, man was to treat the animals with the spirit of kindness and love. This spirit of unity and love is also to exist between man and man, to an even higher degree than it exists between man and the animals; and then the highest expression of love and service is to be manifested by man to his Creator, who is to be the object of supreme love and worship.

References.—"Parts of His Ways," section 11, chapter 22. "Principles of True Science:" Animals Named by Adam, "Patriarchs and Prophets," p. 51; "Christian Education," p. 207; Animals, God's Care for, "Desire of Ages," p. 500.

Questions and Suggestions.—What relation did God design that man should sustain to the vegetable kingdom? What relation was he to sustain to the animal kingdom? What does David say in the eighth psalm with reference to man's dominion? How did the animals deport themselves when they were in Eden with Adam and Eve? "Patriarchs and Prophets," p. 50. How does the intelligence of the animals compare with that of man? To whom were the animals to express their allegiance? To whom was man made responsible? Is the original plan of God with reference to the relation between man and the lower animals still carried out? What has brought about the change? How should we treat the animals? What should be the relation existing between man and man? Between man and God? Is the life of animals maintained in the same way as that of man? Eccl. 3:17-20. How does the Lord design that man should express his gratitude to his Creator for His constant love and care? How does man rank with the angels?

LESSON XXXIX.

Man's Relation to Man.

We have considered man's relation to his surroundings, including light, heat, air, water, soil, plants, and animals. Now we shall consider him with reference to his relation to his fellow-beings. We find in the Word of God a rule of life, showing how we should relate ourselves to all of God's creatures.

The law of God, called the ten commandments, is the great rule of life. The last six precepts speak of our relation to our fellow-men, while the first four speak of our duty toward God. Christ, in speaking of the great principles of the ten commandments, sums them up in these words: "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind. This is the first and great commandment. And the second is like unto it, Thou shalt love thy neighbor as thyself."

You see by this scripture that we are to manifest the spirit of love toward our fellow-creatures. We are not to love only those who love us, but we are to love our enemies. Christ said (Matt. 5:44), "Love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you, and persecute you; that ye may be the children of your Father which is in heaven." Then He gives the reason why we should do so, in the following words: "For He [God] maketh His sun to rise on the evil and on the good, and sendeth rain on the just and on the unjust."

Man is very selfish by nature, and naturally looks out for himself. How often we hear the expression, "I am going to look out for number one;" or, "If I don't look out for myself, no one will look out for me." But this spirit is entirely con-

trary to that which Paul exhorts us to have, in Phil. 2:3, 4: "Let nothing be done through strife or vainglory; but in lowliness of mind let each esteem other better than themselves. Look not every man on his own things, but every man also on the things of others."

When we have this spirit of love and sacrifice for others, it proves that we have been born again,—in other words, that we have been converted. We learn this from reading 1 John 3:14, 15: "We know that we have passed from death unto life, because we love the brethren. He that loveth not his brother abideth in death. Whosoever hateth his brother is a murderer; and ye know that no murderer hath eternal life abiding in him." In another place he says, "A new commandment write I unto you, that ye love one another." Is this commandment new to us? It may not be new so far as having heard or read it before, but it may be new in our experience.

References.—"Parts of His Ways," section 11, chapter 23. Read works on Civics and Moral Science, but remember that the Bible is the *only authority* on these subjects.

Questions and Suggestions.—What relations of man have we considered in our study thus far? What relation is considered in this lesson? What great rule in the Bible do we find which makes plain man's relation to all God's creatures? What portion of this rule shows our relation to our fellow-men? Which commandments show man's relation to his Creator? In what two commandments does Christ sum up the principles of the ten commandments? Shall we love only those who love us? Why should we love our enemies? Naturally, is not man more careful to look out for his own interests than those of his neighbor? What expressions are often heard which show this spirit of selfishness? What spirit are we exhorted by Paul to have? What does this spirit of love prove? What "new commandment" does Paul give us?

LESSON XL.

Man's Relation to the Creator.

We learn by reading Genesis 1:27 that God created man in His own image. This does not mean simply God's physical image, but also His spiritual image; in other words, that man was created with the same character which God possesses. God created man that He might have creatures upon whom to bestow His love, and that they in turn might show their love and gratitude toward Him. The first four commandments show plainly the relation of man to God. The first commandment, "Thou shalt have no other gods before Me," shows that man is to bestow his supreme love and affection upon his Maker, and that nothing is to come between him and his God.

There is great danger of our becoming so taken up with the things which God has created, that we shall bestow our love and affection upon them instead of upon the One who made them. This was the case with the antediluvians. They took the treasures of nature and used them for their own selfish purposes instead of using them to glorify God. The heathen were in great spiritual darkness, as described by Paul in the first chapter of Romans. He says of them that when they knew God, they glorified Him not as God, neither were thankful; but became vain in their imaginations, and their foolish hearts were darkened. Professing themselves to be wise, they became fools, and changed the truth of God into a lie, and worshiped and served the things created more than the Creator. Paul, in the twentieth verse, tells us that the things created reveal the Creator and His power. But the heathen, because of the selfishness of their hearts, forgot God, and worshiped the things He had made, in the place of God.

There is danger of our doing the very same thing to-day. In Revelation 4:11 we learn that God created all things for

His pleasure. The Lord tells us through the prophet Isaiah that He has created man for His glory; so the one thought in our minds should continually be, What can I do to glorify my Maker? Christ tells us how we can do this. In Matt. 5:16 He says, "Let your light so shine before men, that they may see your good works, and glorify your Father which is in heaven." Read in Acts 12:20-23 what happened to a man who was not willing to give God the glory due unto His name.

References.—"Parts of His Ways," section II, chapter 24.

Questions and Suggestions.—In whose image was man created? Does this mean simply his physical image? Why was man created? For what purpose does he exist? What does the first commandment mean to you? In our study of nature, is there any danger of our becoming so interested in the creature that we entirely lose sight of the Creator? What instance is recorded of such an experience? What was the result? Why did these people forget God? Is there any danger of our experience being similar? For what were all things created? How may we glorify our Maker?

LESSON XLI.

The Body a Symbol of the Church.

We have seen in our study of the different phases of nature that they are constantly employed in the Scriptures as symbols of spiritual things. In this chapter we have been studying man, the highest product of God's creative power. Do the Scriptures speak of man in a symbolic way? If so, what does his body, with all of its different members, represent? We find that the apostle Paul, more than any other Bible writer, used man's body and its members to represent spiritual truths. In Rom. 12:4, 5 Paul employs the body to represent the church: "For as we have many members in one body, and all members have not the same office; so we, being many, are one body in Christ, and every one members one of another." In other places Paul speaks of Christ being the head of the church. Eph. 1:22; 4:15; Col. 1:18. Christ's fol-

lowers constitute the members of the body, which is the church. Just as the head directs and controls all the members of the physical body, so Christ, the head of the church, directs and controls its members. In 1 Cor. 12:12-31 we find Paul again making the body a symbol of the church and the manifestations of the Spirit in the church. He speaks of the different manifestations of the Spirit in the church, and says that they are all manifestations of the same Spirit.

While the Spirit is one, it has many ways of manifesting itself; while the body is one, yet it is composed of many different members, which produce many different manifestations. Let us read Paul's own words: "For the body is not one member, but many. If the foot shall say, Because I am not the hand, I am not of the body; is it therefore not of the body? And if the ear shall say, Because I am not the eye, I am not of the body; is it therefore not of the body? If the whole body were an eye, where were the hearing? If the whole were hearing, where were the smelling? But now hath God set the members every one of them in the body, as it hath pleased Him. And if they were all one member, where were the body? But now are they many members, yet but one body. And the eye can not say unto the hand, I have no need of thee; nor again the head to the feet, I have no need of you. Nay, much more those members of the body, which seem to be more feeble, are necessary; and those members of the body, which we think to be less honorable, upon these we bestow more abundant honor; and our uncomely parts have more abundant comeliness. For our comely parts have no need; but God hath tempered the body together, having given more abundant honor to that part which lacked; that there should be no schism in the body; but that the members should have the same care one for another. And whether one member suffer, all the members suffer with it; or one member be honored, all the members rejoice with it. Now ye are the body of Christ, and members in particular." 1 Cor. 12:14-27. The different manifestations of the Spirit

represent the workings of the different members. We should so live that we may become members of the great church which God is establishing on the earth. This church is compared to a temple in Eph. 2:19-22: "Now therefore ye are no more strangers and foreigners, but fellow-citizens with the saints, and of the household of God; and are built upon the foundation of the apostles and prophets, Jesus Christ Himself being the chief corner-stone; in whom all the building fitly framed together groweth unto an holy temple in the Lord; in whom ye also are builded together for an habitation of God through the Spirit." We are to be stones in this temple, each one filling the place which God designs we shall fill.

References.—"Parts of His Ways," section 11, chapter 25.

Questions and Suggestions.—Why are the different phases of Nature used to represent spiritual things in the Scriptures? Is man used in this way? What does he represent? What is the office of the head? Who is the head? Who are the members? Is the body used to symbolize anything else? By whom is it so used? What illustration is used to show the dependence of the members on one another? This closes the study of God's works in creation, and now we shall take up in the succeeding chapters God's work in redemption.

Chapter XII.

THE SABBATH.

(Scripture Basis, Gen. 2 : 1–3.)

LESSON I.

The Origin of the Sabbath.

1. During how many days was God engaged in the work of creation? What did He do each day?

2. When God had finished, what did He say of all the things He had made? Gen. 1 : 31.

3. What was the condition of the heavens and the earth at the close of the sixth day? Gen. 2 : 1.

4. What did God do on the seventh day? Gen. 2 : 2.

5. Was the Creator wearied and exhausted from the six days' labor? Isa. 40 : 28; P. P., p. 47. Will He help us when we are weary? Verses 29-31.

6. What did the Creator do during the seventh day? *Ans.*—He rejoiced in His works and was refreshed. Ex. 31 : 17.

7. What did God do after He had rested? Gen. 2 : 3.

8. Why did He bless and sanctify the seventh day? *Id.*

9. What was the result of blessing and sanctifying the seventh day? *Ans.*—It was made holy.

10. What command did God give to His people with reference to the Sabbath? Ex. 20 : 8.

11. What are they to do during the six days? Verse 9.

12. Were they to do any work on the Sabbath? Verse 10. Christ taught that work which is necessary to relieve suffering is proper on the Sabbath. Luke 14 : 1-6; Matt. 12 : 10-13.

13. Why are we commanded to keep the Sabbath? Ex. 20:11.

14. What reason is here given for blessing and hallowing the seventh day?

15. What may the Sabbath properly be called? *Ans.*—The world's birthday. What does David call it? *Ans.*—God's memorial. Ps. 135:13.

16. For whom did God make the Sabbath? Mark 2:27, 28.

17. Of what is the Sabbath a sign? Eze. 20:12, 20.

References.—"Principles of True Science:" Sabbath, Origin of, "Patriarchs and Prophets," p. 111; "Christian Education," p. 190. "Parts of His Ways," section 12, chapter 1.

Suggestions to Teachers.—The students have followed the Lord through the work of creation, noting each part as it was made. Each thing as it was made, God pronounced good. But now the work is completed, and the Creator takes a survey of His created works as they are perfectly and harmoniously carrying out His will. The sight of it is refreshing to His soul, and He pronounces the final benediction, "Very good." An earthly mechanic takes delight in watching the working of that which his imperfect mind is able to produce, but much more the Master Mechanic, who is "excellent in working." Isa. 28:29.

LESSON II.

The Purpose of the Sabbath.

1. When did God make the Sabbath?

2. To whom was it given?

3. Which existed in the world first, sin or the Sabbath? Had sin not entered the world, would God's children be keeping the Sabbath?

4. Did God give man the Sabbath that he might have physical rest? G. C., p. 676, par. 3; p. 677, par. 2.

5. For what purpose was the Sabbath given to Adam and Eve and their posterity? P. P., p. 47, par. 3.

6. Of what is Sabbath observance a grateful acknowledgment? P. P., p. 48, par. 1.

7. Why was a Sabbath essential for man in Eden? P. P., p. 48, par. 2.

8. What does God design the Sabbath shall do for us now? P. P., p. 48, par. 3.

9. What does the Sabbath bid us do? *Id.*

10. How should the Sabbath be spent by parents and children? T., vol. 2, pp. 582-585.

11. What influence will the study of God's works have on the children? *Id.*, p. 584.

12. How is the Sabbath usually regarded by the children? *Ans.*—As a long, uninteresting day, which they will be glad to have pass, and dread to have return.

13. What kind of day should it be for the children? T., vol. 2, pp. 584, 585.

14. How does the prophet Isaiah say that we should regard the Sabbath? Isa. 58:13.

15. Will the Sabbath be kept in the new earth? Isa. 66:23.

References.—"Principles of True Science:" See Sabbath; Nature, the Sabbath Points to, "Desire of Ages," pp. 281, 282, 289; and Parable Teaching and the Sabbath, "Christ's Object Lessons," pp. 22, 23. "Parts of His Ways," section 12, chapter 2.

Suggestions to Teachers.—By the study of this lesson it will be seen that God designed that the Sabbath should be a day when His children should leave their own interests, and contemplate more fully His character as expressed in His handiworks. Each Sabbath, as we study God's creation, we are to see new evidences of His wisdom, power, and love. This will strengthen our faith in His power to redeem us from the bondage of sin, and to create within us clean hearts and renew within us right spirits. Every Sabbath the children should be taken out into the groves and fields, where they can learn to commune with God through Nature. Parents and teachers have a responsibility in this direction which has not yet been sensed as it should be. Read "Healthful Living," p. 151.

Chapter XIII.

THE FALL OF MAN.

(Scripture Basis, Gen. 2 and 3.)

LESSON I.

The First Sin.

1. Were there other holy beings who lived before Adam and Eve were created? Job 38:7. (Read the context.)

2. Where is the name of one of these beings recorded? Isa. 14:12.

3. What is the meaning of the name Lucifer? *Ans.*—"The Shining One," or "Light Bearer."

4. Where have we a description of Lucifer? Eze. 28:11-19. What earthly character does Ezekiel use to represent Lucifer? Verse 12.

5. What does the prophet say of Lucifer's wisdom and beauty? Verse 12.

6. What kind of character did he possess? Verse 15.

7. Describe Lucifer's covering. Verse 13.

8. What is he called in verses 14 and 16? What did he cover? 2 Chron. 3:10-13; Ex. 25:17-22.

9. Where had Lucifer walked? Eze. 28:14.

10. While Lucifer was occupying the exalted position which God had given him, what feelings came into his heart? Eze. 28:17; Isa. 14:13, 14.

11. What gave rise to this feeling of self-exaltation and jealousy? P. P., p. 35.

12. Of whom was Lucifer jealous? Why? P. P., pp. 36, 37.

13. What was the result of his rebellion? Isa. 14:12, 15; Eze. 28:16, 17; Rev. 12:7-9; Luke 10:18.

14. Where did Lucifer go when cast out of heaven? Eze. 28:13, first clause.

15. In the Scriptures by what names is Lucifer called after he sinned?

16. Is Satan still a glorious being? 2 Cor. 11:14.

17. Why did not God destroy Satan? P. P., p. 42, par. 3.

18. Did any of the angels join with Satan in his rebellion against God? Rev. 12:7-9. P. P., p. 38, par. 3.

19. What are Satan and his angels doing at the present time? 1 Peter 5:8; Job 1:6-8; Matt. 4:24; Luke 8:2; Rev. 16:13, 14.

References.—"Parts of His Ways," section 13, chapter 1. "Patriarchs and Prophets," read Introduction.

Suggestions to Teachers.—Before taking up the test which was brought upon Adam and Eve, it seems best to give a lesson on the origin of sin. This will make the connection of the lessons more complete, and save the pupils asking a great many questions about Satan, as to where he came from, and how he sinned. Undoubtedly it was some time before the creation of our first parents that the rebellion took place in heaven. But Satan improved the first opportunity to lead them into sin. He is desirous of gaining as many as possible who will share his fate. All of God's creatures living in the different worlds were subject to his temptations. Read the Introduction in "Patriarchs and Prophets," as this chapter throws much light on the subject.

LESSON II.

The Temptation.

1. In what garden did God place Adam and Eve?

2. How were they to spend their time in the Garden of Eden?

3. What kinds of trees did the Lord place in the garden?

4. Name the two most important trees.

5. What command did God give to Adam and Eve about eating of the fruit of the trees? Gen. 2:16, 17.

6. What was the purpose of the tree of life? Gen. 3:22. Of the tree of knowledge of good and evil? *Ans.*—It was to test their loyalty to their Creator. P. P., p. 53, par. 3.

7. Who planned to destroy the peace and happiness of our first parents in their Eden home? P. P., p. 52, par. 1.

8. Were they warned of the danger that threatened them? By whom? P. P., p. 52, par. 2; p. 53, par. 2.

9. Upon what condition are all of God's creatures placed before they are made immortal? P. P., p. 53, par. 1.

10. What medium did Satan use to deceive Eve? Gen. 3:1; P. P., p. 53, par. 4.

11. How did the serpent compare with the beasts of the field in beauty and wisdom? *Id.*

12. Describe the appearance of the serpent. *Id.*

13. What was the serpent doing in the tree when Eve first saw it?

14. What caution had the angels given to Eve? P. P., p. 53, par. 5.

15. Why did God place these restrictions upon Adam and Eve?

16. Why did not God create them so they could not do wrong?

17. How do we show our love to God? John 5:3.

18. If we truly love God, will the keeping of His commandments give us pain or pleasure? *Id.*

References.—"Parts of His Ways," section 13, chapter 2. "Patriarchs and Prophets," read Introduction.

Suggestions to Teachers.—In this lesson the teacher should develop the thought that God did not want man to be like a machine, to do right because he could not do otherwise. So the Lord made all His intelligent creatures free moral agents, free to serve Him out of pure love for what He was to them, or free to serve self. In this lesson we learn the means which God chose to test the loyalty and devotion of Adam and Eve. God is testing us day by day, in little things as well as the great things, to see if we love Him and desire to be loyal subjects of His government. Mention instances in the Bible in which God tested men, such as Abraham, Job, etc., and note the character of the tests.

LESSON III.

The Fall of Man.

1. What was Eve doing when Satan spoke to her through the serpent? P. P., p. 54. What thoughts were passing through her mind? *Id.*

2. As she was wondering why God had withheld this fruit, what did the serpent say? Gen. 3:1. When is it that Satan tempts us?

3. How did Eve reply to the serpent? Verses 2, 3.

4. What great lie did Satan tell? Verse 4. Ought not this to have revealed to Eve that she was talking with the one against whom they had been warned?

5. What did the serpent say would be the result of eating the forbidden fruit? Verse 5. P. P., p. 54, par. 2.

6. What finally caused Eve to partake of the fruit? What persuaded Adam to eat of it? Verse 5. P. P., p. 56.

7. What influence did the eating of the fruit have upon them? Verse 7.

8. What did they discover which they did not know before? How did they cover their naked bodies? *Id.*

9. With what were their bodies surrounded before they sinned? Gen. 2:25. P. P., p. 45, par. 3; p. 57, par. 1.

10. How did Adam and Eve feel when God called them? What excuse did they give for hiding? Gen. 3:8-11. P. P., p. 57, par. 4.

11. Upon whom did Adam lay the blame for the trouble they were in? Verse 12.

12. When the Lord asked Eve what she had done, what did she reply? Verse 13.

13. Do the children of Adam and Eve manifest this same trait when they get into trouble?

14. What curse did the Lord pronounce upon the serpent? Verse 14.

15. What curse was pronounced upon Eve? Verse 16. Upon Adam? Verses 17-19. Were these for their good? P. P., pp. 58-60.

16. Were they allowed to remain in the garden? Verses 22-24.

17. How did the Lord provide for the protection of their bodies? Verse 21.

18. What vocation was Adam to follow? Verse 23.

19. Name Adam and Eve's first two children. What vocation did they follow? Gen. 4:1, 2.

20. What wonderful plan is referred to in Gen. 3:15? *Ans.*—The plan of redemption. P. P., pp. 65, 66.

References.—The same as in lesson 2.

Suggestions to Teachers.—This lesson shows how artfully Satan uses his temptations to overcome us. We must shun the very appearance of evil. We must be careful not to give an inch of ground. We must not compromise a single principle of truth. James tells us how we are led into temptation. James 1:13. Let us read it and heed it. Read chapter 3, The Temptation and Fall, in "Patriarchs and Prophets."

LESSON IV.

The Influence of Sin on Man.

1. If our first parents had not sinned, how long would they have lived?

2. What would have perpetuated their lives even after they had sinned? Gen. 3:22, 23.

3. How long did Adam live? Gen. 5:5.

4. Give the names and ages of the patriarchs mentioned in the fifth chapter of Genesis.

5. Which one lived the longest?

6. What was the average age of these patriarchs?

7. How long did Noah live? Gen. 9:29.

8. How long was it after Noah's death, before Abraham was born? (See chronology of your Bible.)

9. How long did Abraham live? Isaac? Jacob? Joseph? Moses?

10. What was the average age of those named in No. 9?

11. How do you account for the sudden decrease in the length of man's life?

12. What had God told Adam and Eve would be the result of eating the forbidden fruit? Gen. 2:17, margin.

13. How long did David, Saul, and Samuel live?

14. What does David say was the allotted period of man's life in his day? Ps. 90:10.

15. What is the average length of man's life at the present time? *Ans.*—About thirty years.

16. What petition does David make in view of the shortness of life? Ps. 90:12; 39:4, 5.

17. Mention some of the diseases which are destroying human life so rapidly. Are new diseases appearing all the time?

18. What does this condition of things show? *Ans.*—That the whole human race will be exterminated in a few centuries unless the conditions are changed.

19. Has sin caused mental degeneration as well as physical? Compare the men of our time with those who lived before the flood. P. P., pp. 82, 83.

References.—"Principles of True Science:" Man, Degeneration of, "Spiritual Gifts," vol. 4, p. 124; Man, Height of, "Spiritual Gifts," vol. 3, p. 34; "Patriarchs and Prophets," p. 45; Adam and Eve, Physically, "Spiritual Gifts," vol. 3, p. 120. "Parts of His Ways," section 13, chapter 3.

Suggestions to Teachers.—Sin is self-destructive. The reason why Adam's children who lived before the flood lived so long was because Adam had access to the tree of life. Also he lived a righteous life, so that he imparted much of his own vigor and strength to his first descendants. We see by the study of this lesson that sin degenerates man physically, mentally, and morally. If we would develop the whole man we must faithfully heed all of God's requirements. Study the lives of Moses, Solomon, and David to illustrate how the Lord will bless those who are loyal to Him. In the next lesson we will show how sin affected plants and the lower animals.

LESSON V.

The Influence of Sin on the Animals.

1. Did Adam have control over the lower animals before he sinned? Give texts to prove your answer.

2. Did the lower animals have to suffer on account of man's sin? Gen. 4:4.

3. How did the antediluvians regard the lives of animals? P. P., p. 92.

4. What did they do with the flesh of dead animals? *Id.*

5. What influence did this blood-thirsty work have upon them? *Id.*

6. How did they regard human life?

7. What relation did God design should exist between man and the lower animals? P. P., pp. 45, 50.

8. How did Noah regard the animals after they came forth from the ark? P. P., p. 106. What caused them to be so fierce? *Ans.*—The way they were treated by the antediluvians before they entered the ark.

9. What promise did God make to Noah and his family? Gen. 9:2, 3.

10. What permission did God give to Noah? Gen. 9:3. Why? P. P., p. 107.

11. What animals can you name that will take the life of man?

12. Give instances recorded in the Scriptures where human life has been taken by the lion and the bear.

13. Is this spirit of antagonism manifested among the animals toward one another?

14. Give examples of animals which prey upon other animals. *Ans.*—

(1) Water animals. Fish live on smaller fish and small insects which live in the water; starfish, upon the oyster, etc.

(2) Air animals. The eagle and hawk live upon rabbits, mice, and smaller birds; small birds live upon insects, etc.

(3) Land animals. The lion and bear will attack cattle, deer, and smaller animals; the wolf attacks the sheep, etc.

15. Has the Lord given any instruction concerning the proper treatment of animals?

16. Can you tell anything about the character of a man by noting the disposition of his beasts?

References.—"Principles of True Science:" Animals, Size of before the Flood, "Spiritual Gifts," vol. 3, p. 92; Animals, the Confused Species, "Spiritual Gifts," vol. 3, p. 75; Animals, Diseased, "Spiritual Gifts," vol. 4, pp. 146, 148. "Parts of His Ways," section 13, chapter 4.

Suggestions to Teachers.—The spirit of quarreling, fighting, and killing, among animals, is the result of sin. Sin in six thousand years has done a fearful work. Many, even those who profess to be Chris-

tians, treat their animals unmercifully by whipping and beating them. Many do not obey the Lord nearly as promptly and as fully as the domestic animals obey their masters. Read Ps. 32:9.

LESSON VI.

The Influence of Sin on the Plants.

1. What have we found to be the influence of sin on man and the lower animals? P. P., p. 59, par. 4.

2. Did sin affect the plant creation?

3. What did the Lord do to the ground on account of Adam's sin? Gen. 3:17.

4. What did this cause the earth to bring forth? Verse 18.

5. What influence did sin have on the flowers and trees? P. P., p. 62. What effect did the fading of the flowers have on Adam and Eve? *Id.*

6. What produces thorns and briers? "He [God] never made a thorn, a thistle, or a tare. These are Satan's works, the result of degeneration, introduced by him among the precious things." U. T.

7. Even though there are thorns and thistles on the earth, are the love and mercy of God still seen? C. E., p. 67.

8. When was the earth cursed a second time? *Ans.*—When Cain killed his brother Abel. Gen. 4:8-12.

9. What was the result of this second cursing of the earth? Verse 12.

10. How does the earth yield her increase at the present time?

11. When the farmer puts in his crops, can he tell with any certainty about how large a yield he will have?

12. Ask your parents whether the soil yields as large crops now as when they were children.

13. What causes the crops to be so uncertain?

14. Can you think of other ways in which the earth is suffering in consequence of sin, besides those already mentioned?

References.—"Principles of True Science:" Plants in the Beginning, "Spiritual Gifts," vol. 3, p. 33; Thorns, the Origin of, unpublished Testimonies; Thorns a Result of Adam's Sin, "Spiritual Gifts," vol. 3, p. 45; Briers and Thorns, "Testimonies for the Church," vol. 4, p. 311. "Parts of His Ways," section 13, chapter 5.

Suggestions to Teachers.—This lesson shows that not only man and the animals are affected by sin, but also the plants. Adam knew nothing of death and decay before he saw it in nature about him. Nature constantly bore witness of the terrible consequences of sin. We think but little of a fading leaf or flower, but they mourned when they first saw them as we weep for our dead. This shows us how far man has wandered away from God. We soon forget about those who have passed away, we are so taken up with the things that are transpiring daily about us. The next lesson will tell of other ways in which sin has marred and spoiled man's once beautiful home. The teacher should collect thorns, thistles, briers, etc., to illustrate this lesson.

LESSON VII.

"The Whole Creation Groaneth."

1. How does the apostle Paul describe the condition of the earth under the curse? Rom. 8:22.

2. How many curses have we learned that God pronounced upon the earth?

3. When was each one pronounced? What were the results?

4. In what condition was the earth in the days of Noah? P. P., p. 90, par. 1.

5. What was the condition of the human race? *Id.*

6. Mention ways in which Satan is visiting his wrath upon the earth. *Ans.*—

(1) In earthquakes and volcanoes. How are these caused? P. P., p. 108, par. 2.

(2) In tidal waves, water-spouts, hail-storms, and cloudbursts.

(3) In storms by land and sea,—hurricanes, tornadoes, cyclones, and whirlwinds.

(4) In excessive heat, causing sunstroke.

7. What do you notice as you read over this list of destructive agencies? *Ans.*—That the very things which God designed should be a blessing to man have been used as a curse to him.

8. Who is guilty of thus abusing and misusing these gifts of God? Eph. 2:2.

9. Have storms been more frequent and more destructive in recent years?

10. Who prophesied of the elements in the last days? Luke 21:25, 26.

11. How will these things affect the people? *Id.*

12. Why does Satan cause the earth to be visited by storms, earthquakes, tidal-waves, etc? G. C., pp. 589, 590.

13. Does Satan have absolute control of the elements and forces of nature? *Id.*

14. How does Satan know how to combine the elements to make them so destructive? *Id.*

References.—"Principles of True Science:" See Curses, Earthquakes, Volcanoes, and Storms. "Parts of His Ways," section 13, chapter 6.

Suggestions to Teachers.—We see by this lesson that Satan has a large control over the earth, but God is over all. This is plainly brought out in the first two chapters of Job. Read these chapters carefully. Satan is determined to destroy the human race if possible; but God will not allow him to afflict His people except as it is for their good in the development of character. Find scriptures which show how tenderly God regards His children and protects them from harm and danger. In this chapter we have learned of the terrible workings of sin, and how all God's fair creation has been marred by it. But God provided a plan whereby man might be restored. But only a few would respond to God's mercy. The sons and daughters of Adam grew more and more wicked, until God finally determined to destroy the earth by a flood. This will be studied in the next chapter.

Chapter XIV.

THE FLOOD.

(Scripture Basis, Gen. 6–9.)

LESSON I.

The Plan of Redemption.

1. When man fell, did God have a plan in mind whereby he might be saved?

2. Where do we find the first reference made to this plan? Gen. 3:15.

3. When was this plan of redemption conceived? Rev. 13:8; P. P., p. 62.

4. Who conceived the plan? *Ans.*—God and Christ. Zech. 6:13; P. P., p. 63, par. 2.

5. How did the news of man's fall affect the heavenly beings? P. P., p. 63, par. 1.

6. How only could man's salvation be secured? Acts 4:12; P. P., p. 64, par. 2.

7. How did the angels feel about having their beloved Commander die for man? P. P., pp. 64, 65. What did they offer to do? *Id.*

8. Why could not an angel redeem man? *Id.* Were the angels to have any part in the work of redemption? *Id.* Ps. 103:20, 21; Heb. 1:14.

9. How much did God love this world in its fallen condition? John 3:16; Rom. 5:8.

10. How great a sinner is God able to save? Heb. 7:25.

11. What was the moral condition of the earth in the days of Noah? Gen. 6:1-6; P. P., pp. 90-96.

12. What was Noah's condition? Gen. 6:8; 7:1.

13. In what did the wickedness of the antediluvians consist? Matt. 24:37, 38; Luke 17:26, 27.

14. How did the Lord feel because of man's great wickedness? Gen. 6:6.

15. What did the Lord determine to do on account of man's wickedness? Verses 7, 13.

16. How was the Lord to accomplish this great destruction? Verse 17.

17. Did God plan to save any beside Noah? 1 Peter 3:20. *Ans.*—Noah preached the gospel 120 years. P. P., pp. 95, 96.

18. Has God always warned the world before visiting it with some great destruction? Give instances.

References.—"Parts of His Ways," section 14, chapter 1. "Patriarchs and Prophets," read chapter on The Flood.

Suggestions to Teachers.—The most of the year's work in Bible-Nature study is given to the study of creation. But a small portion of the Bible is given to this subject, a greater portion being devoted to the work of God in recreating or redeeming lost mankind. This phase of God's work is more fully developed in the Bible class. We see, then, that creation and redemption are the two great themes which occupy the minds of the students in the study of Science and Nature, as well as in the study of the Bible. These will be studied throughout eternity.

LESSON II.

The Building of the Ark.

1. Where do we find a description of the flood?

2. To whom did God reveal His plan of destroying the earth by a flood of water?

3. What means did God provide to save the souls which would receive Noah's message?

4. Out of what material was the ark made? Gen. 6:14; P. P., p. 95.

5. Give the dimensions of the ark, as described in verses 15, 16.

6. How many stories high was the ark? Did it consist of one large room, or was it divided into many rooms? How large was the ark in English measure? How would it compare with the large steamers which cross the ocean?

7. What was Noah to place in the ark? Verses 19-22.

8. Where did Noah build the ark? Do you think the people laughed and jeered at Noah as he was constructing the ark on the dry land?

9. Did it take faith on Noah's part to do what the Lord commanded him? Heb. 11:7. Had Noah ever seen a flood of waters? Had it ever rained before the flood? Had Noah followed human reasoning, instead of acting by faith, would he have built the ark? How necessary is faith? Heb. 11:6.

10. How were the animals taken into the ark? How many of each kind were taken? Gen. 7:1-3. P. P., pp. 97, 98.

11. When Noah and his family and all that God had commanded were safe in the ark, how many days did they wait before it rained? Who shut Noah and his family in the ark? Verses 4-10; P. P., p. 98.

12. How did the people conduct themselves while Noah was seven days in the ark, waiting for the rain? How did they act on the eighth day? P. P., pp. 98, 99.

13. What lessons may we learn from the experience of the antediluvians?

References.—"Principles of True Science:" Gopher or Cypress Wood, "Spiritual Gifts," vol. 3, p. 66; "Patriarchs and Prophets," p. 95. "Parts of His Ways," section 14, chapter 2.

Suggestions to Teachers.—In this lesson we see a practical demonstration of God's willingness to save His children from destruction. Even though the antediluvians had gone so far into sin, yet the Lord in His mercy sent a message of warning, and provided a means for their escape from the impending destruction. They did not believe God's Word. They could not see how it was possible that the earth should be deluged with a flood. There was only one man who had implicit faith and confidence in His word, and that was Noah. He did not stop to reason upon the matter, but he showed his implicit faith by his works; and the greatest demonstration of that faith was the building of the ark. These lessons should be impressed upon the minds of the pupils, and many others which may easily be drawn from the narrative.

LESSON III.

The Extent of the Flood.

1. How was the flood of waters brought upon the earth? Gen. 7:11, 12. Describe the appearance of the heavens on the eighth day. Describe the bursting of the waters from the earth. P. P., p. 99.

2. How long did it rain? Verse 12. What effect did the waters have upon the animals that were outside of the ark? Verses 21-23. How long was the ark upon the earth before it began to float? Verse 17.

3. Could not the animals and human beings save their lives by climbing to the tops of mountains? Verses 19, 20. How long did the waters prevail upon the earth? P. P., p. 100; Gen. 7:11; 8:13, 14.

4. Did God forget Noah during his stormy voyage on the restless waters? Gen. 8:1. Did He remember more than Noah and his family? *Id.*

5. When God remembered Noah and the ark with its occupants, what step did He take to assuage the waters? Verses 1, 2.

6. How long were the waters upon the earth before they began to abate? Verse 3. Did the waters decrease gradually, or quickly, from off the earth?

7. What place did God provide to protect the ark from the violence of the waters? Verses 4, 5. How high did the waters ascend above the tops of the highest mountains? Gen. 7:20. When were the tops of the mountains first seen? Gen. 8:5.

8. How long after this before Noah sent forth a raven from the ark? What did the raven do? Verse 7, margin. What other bird did he send forth besides the raven? What did the dove do? Verses 8, 9. How long was it before he

sent out another dove? When did the dove return, and what did it bring with it?

9. What did the olive leaf brought back by the dove indicate to Noah? Did Noah immediately go out of the ark? What happened to the third dove, which was sent out seven days afterward? Verse 12.

10. How did Noah learn when the waters were completely dried up? Verse 13. How long were Noah and his family in the ark? Gen. 8:13, 14; 7:6, 11. How did Noah know when to go into the ark? When to go out? Gen. 8:15.

11. What command did the Lord give to Noah with reference to leaving the ark and taking the animals with him? Verses 16, 17. How did Noah show his gratitude to God for His preserving care during the time of the flood? Verse 20.

12. How did the Lord regard Noah's offerings? Verse 21. What pledge did the Lord make to Noah and his family? *Id.* What promise did the Lord make concerning seedtime and harvest? Cold and heat? Summer and winter? Night and day? Verse 22. What token did the Lord give to Noah that He would not destroy the earth again by a flood of waters? What causes the rainbow? Was there a rainbow before the flood?

References.—"Principles of True Science:" See Flood. "Parts of His Ways," section 14, chapter 3.

Suggestions to Teachers.—In the study of this lesson, we clearly see that the Lord does not forget His faithful children, even in the time of adversity. God not only remembered Noah, but He also remembered every living thing, even the cattle that were with him in the ark. We see, also, on the part of Noah, a willingness to follow the Lord's orders, for He did not leave the ark until the Lord called him forth. In the last two lessons we have learned that God destroyed all flesh that moved upon the earth. All that was highly prized by the antediluvians perished with them. The earth was reduced to chaos, and the description given in Gen. 1:2 would be very fitting for the appearance of the earth during the time of the flood. In our next lesson we shall consider how the face of the earth was disfigured by the flood. Read "Patriarchs and Prophets," pp. 105-107.

LESSON IV.

The Earth's Surface after the Flood.

1. Describe the violence of the waters as they issued from the bowels of the earth. P. P., p. 99.

2. What effect did these streams and jets of water have upon the rocks? *Id.*

3. What became of the banks of the rivers as they were filled with water? *Id.*

4. How did Satan feel as he was surrounded by the warring elements? *Id.*

5. In what respect do you think the surface of the earth after the flood differed from its appearance before the flood? P. P., p. 107.

6. How many curses had now visited the earth? Name and describe each. Which one was the most terrible in its results?

7. With what was the face of the earth strewn after the waters had subsided? If the bodies had been permitted to decompose, what would have been the condition of the atmosphere? How were the bodies of the animals buried? P. P., p. 108.

8. What agencies did God use in burying the bodies of the dead animals? How does the surface of the earth at the present time compare with its condition when first created? P. P., pp. 44, 108.

9. Is it a great thing for the Lord to cast down the mountains and hills, and to move islands? Isa. 40:12, 15.

10. What do scientists call the study of the earth's crust? *Ans.*—Geology. If geologists would study and believe the record of the flood as given in the Bible, would their books be so full of error? What did the Lord design the study of the earth's crust (geology) should do for the student? P. P.,

p. 112. What do geologists claim to find evidence of in their study of the earth's crust? *Id.*

11. What will every student of true science do when he finds that his theories are contrary to the plain statements of God's Word? Rom. 3:4.

References.—"Principles of True Science:" See Flood. "Parts of His Ways," section 14, chapter 4. "Patriarchs and Prophets," read chapter After the Flood.

Suggestions to Teachers.—The earth was greatly disfigured by the flood. Where there were mountains before the flood, there were plains after it; and where there were plains, mountains appeared. The great violence and fury connected with the raging of the water reduced the earth to an almost chaotic condition. Illustrations of the force of the water at the time of the flood may be seen nowadays in the smaller floods which occur in various parts of the world. In the spring of the year when the snow melts, the water does a great deal of damage by washing away the soil, making deep ravines and gullies in the cultivated fields. You can point to these as simple illustrations of how the water caused much greater destruction at the time of the flood. We find the beds of small streams changed more or less from year to year on account of the freshets which occur in the early spring. The water even now, in a small ravine, is causing changes in the earth's surface from year to year. Undoubtedly the surface of the earth now above the water is much less than before the flood. At the present time about one-fourth of the earth's surface is composed of land, and three-fourths water. What is the meaning of Rev. 21:1?

LESSON V.

Minerals Buried by the Flood.

1. What is the meaning of the word mineral? Name some of the common minerals. See lessons 10 and 11, chapter 4.

2. What two great divisions have we in the elements which compose the minerals? See lesson 12, chapter 4.

3. What is the composition of the rocks and stones? Name some of the precious stones. Lesson 13, chapter 4.

4. Did precious stones exist on the earth before the fall of man? Gen. 2:11, 12. What stones are mentioned?

5. What precious metals were also to be found on the earth? *Id.;* P. P., pp. 90, 91.

6. How did the antediluvians use the precious treasures which God had placed in the earth for their use? What were they finally led to worship instead of God? *Id.*

7. What caused them to forget God, and worship the things God had created? Rom. 1:21-27.

8. What influence should the study of God's works have upon the student? Verse 20.

9. What did God do with the gold and silver and precious stones which the antediluvians had used to satisfy their selfish desires? P. P., p. 108.

10. What means did God use to bury these treasures? *Id.*

11. What should the use of God's gifts lead us to do?

12. What was the appearance of the earth when the flood of waters had disappeared?

13. Where were found the heaviest marks of the curse? Why? P. P., p. 108.

14. Where did the curse rest the most lightly? *Id.*

15. What was God's purpose in burying the precious metals and precious stones?

16. What means do men now employ to lift these precious treasures out of the earth?

17. What is this process called? Where do we find the gold and silver most abundant? In digging these precious gifts out of the earth, do men fulfil Genesis 3:19?

References.—"Principles of True Science:" See Gold and Silver. "Parts of His Ways," section 14, chapter 5.

Suggestions to Teachers.—This lesson shows that God provided man with many rich and varied gifts in the beginning, but when he fell into sin, he used them for his own selfish interests. The Lord saw that He must deprive man of many blessings, and cause him to endure hardships, in order that he might learn his entire dependence upon his Maker. Gold and silver were undoubtedly designed to be useful to man in his sinless condition. The Lord placed upon the earth such gifts and treasures as would contribute to the happiness and comfort of man in his sinless state. We find from the Scriptures that these precious metals are used in the construction of the New Jerusalem and

its temple. The heavenly beings wear crowns made of gold, and play upon harps also made of this precious metal. In His Word the Lord uses these precious metals and stones to represent character. Find texts of Scripture where they are so used.

LESSON VI.

How the Flood Affected Vegetation.

1. On what day did God create vegetation?

2. How many classes of plants did God create?

3. What was the nature of the wood of the trees in the beginning? What did it closely resemble? P. P., p. 90.

4. How did the trees then compare with the trees of the present time in the matter of size and beauty? *Id.*

5. Describe the appearance of vegetation in the beginning. P. P., p. 44.

6. What use did the antediluvians make of the wood obtained from the trees? P. P., p. 90.

7. How did the antediluvians defile the beautiful groves which the Lord had created for their pleasure and happiness? P. P., p. 91.

8. What became of the vast forests of trees when the flood was brought upon the earth? P. P., p. 108. What means did God employ to bury this luxuriant vegetation? *Id.*

9. Were all the trees destroyed by the flood? *Id.*

10. How did God provide for the replanting of the earth after the flood? *Id.*

11. What change has taken place in the vegetation which was buried by the flood? P. P., p. 108.

12. Name the three different kinds of coal. *Ans.*—Bituminous, or soft coal; anthracite, or hard coal; and the diamond, a still harder variety.

13. Where in the United States are some of the more important coal districts? What state furnishes the largest amount of coal?

14. What is the source of kerosene oil? P. P., p. 108.

15. What is gasoline? Naphtha? Benzin? How are these oils prepared?

16. Are large quantities of coal and oil used at the present time? Do you think the Lord buried the vegetation in the earth knowing that it would be useful to man in later years? What does this show as to the character of God?

References.—"Principles of True Science:" See Vegetation, Forests, and Coal Beds. "Parts of His Ways," section 14, chapter 6. Physical Geography and Geology, see Coal and Peat.

Suggestions to Teachers.—We have illustrated again in this lesson how God so arranges those things which may prove a curse to us that they may prove a blessing. He buried the choice kinds of wood which the antediluvians used in the erection of their houses, and changed them into coal and oil, to be utilized by future generations. Large amounts of coal and oil are used every year, especially in cities. Were it not for these vast deposits of coal, the world would soon run short of fuel. The energy which was given to plant life before the flood, is now manifest in the form of heat in our stoves and furnaces, and feels very comfortable during the cold winter months.

LESSON VII.

How the Flood Affected the Animals.

1. On what day did the Lord create the animals?

2. How many classes of animals did He create?

3. What homes did He provide for the animals?

4. What relation were the animals to sustain to man? Man to the animals?

5. What caused man to lose his dominion over the lower animals, and the animals to be estranged from man?

6. Were there any wild, fierce animals before the flood? P. P., p. 97.

7. How were these brought into the ark?

8. How did the flood affect the animal kingdom? How were their bodies buried in the earth? Have the skeletons of the animals living before the flood been preserved?

9. Were there any animals living at the time of the flood which God did not create? How did these animals come into existence? Did the Lord create all the animals that are living at the present time? Sp. G., vol. 3, p. 75.

10. What name do scientists give to the remains of plant and animal life which they find buried beneath the earth's surface? *Ans.*—Fossils.

11. Did the Lord design that the bones of the animals should be preserved in the earth? For what purpose? P. P., p. 112.

12. How do the animals at the present time compare in size with those which lived before the flood? *Id.*

13. What does the decrease in the size and strength of animals indicate?

14. Does God design that we shall study the relics which He has preserved in the earth? Why should we study them?

15. Do we need to be guided by the principles laid down in the Word of God as we investigate these things? Why?

References.—"Principles of True Science:" See Animals, Fossils, Bones, and Flood. "Parts of His Ways," section 14, chapter 7. Physical Geography and Geology, see Fossils.

Suggestions to Teachers.—We have found that the remains of plant and animal life which God caused to be buried in the earth, and also the minerals, are of great service to man at the present time. What could we do without the great variety of minerals and metals which are used in the construction of buildings and machinery? The vast coal beds furnish man with the necessary fuel to keep his body warm, and to cook his food. The remains of the animals do not minister to man's temporal necessities, as do those of plants and minerals. They were preserved to show how animals have decreased in size on account of the working of sin, and also to strengthen man's faith in the Word of God, which contains the history of the flood. The elephant and the whale undoubtedly are the largest animals now in existence which lived in the time of the flood. They are thought to be the creatures referred to in the Bible by the names behemoth and leviathan. This lesson concludes our study of the flood as to its effects upon the earth and the things which were placed in it.

LESSON VIII.

The Tower of Babel.

1. What single family did the Lord preserve to repeople the earth after it had been deluged by the flood? How many sons did Noah have? What were their names?

2. What was the character of the sons of Noah? Gen. 9:19-27.

3. What occupation did Noah follow? Verse 20.

4. How many languages did the descendants of Noah speak? Gen. 11:1.

5. What line of work did the descendants of Noah carry on in the land of Shinar? Verses 2, 3. What did they propose to build with the brick and mortar which they made? Verse 4. What was their object in building the tower? P. P., p. 119.

6. After they had been building for some time, what did the Lord determine to do? Verse 5.

7. What was the motive which prompted the building of the tower of Babel? Verse 4.

8. In order that the work of building might be hindered, what did the Lord propose to do? Verses 6, 7. What was the result of confounding their language? Verses 8, 9.

9. Why was the tower called Babel? Verse 9.

10. Had man never sinned, would the inhabitants of the earth have spoken more than one language? Would there have been more than one nation? What language did Adam speak? Do you think that one language was spoken throughout God's entire universe before sin entered the world?

11. Do you think there were different nations in God's universe, or did the inhabitants of different worlds, including our earth, all belong to one family? Eph. 3:14, 15.

12. Are the different languages and nations represented in

the world a result of sin? Did the confounding of the language aid in the plan of repeopling the entire earth?

13. Does God have anything to do with locating the different nations on the face of the earth? Acts 17:26.

14. What purpose does He keep in mind in locating the nations? Verse 27.

15. Into how many divisions is the human family separated by reason of color? *Ans.*—Five divisions. What is the name of these divisions? *Ans.*—Races. Name the five races of men. (*a*) The white, or Caucasian race; (*b*) red, or Indian race; (*c*) black, or Negro race; (*d*) yellow, or Mongolian race; (*e*) brown, or Malay race.

16. Were the different races caused on account of sin? Sp. G., vol. 3, p. 75.

17. Does God love one race more than another? Rom. 2:11; Acts 10:34, 35. Should we have respect to persons? James 2:1-9.

References.—"Patriarchs and Prophets," read chapter on Tower of Babel.

Suggestions to Teachers.—In this lesson we get a glimpse of the character of the descendants of Noah, showing that even though he was righteous before God, yet his sons, especially Ham and Japhet, were selfish, and desirous of worldly ambition and honor. Shem followed more nearly in the steps of his father. The children of Israel were descendants of Shem. In the building of the tower of Babel they desired to get to themselves a great name, but God confounded their language and dispersed them over the face of the earth.

Wickedness has so increased that man in his present condition bears but little resemblance to his Maker. At the present time there are not only many languages, but many nations and different races of men, as their color and physical appearance indicate.

Instead of being one language, one family, as God designed in the beginning, there are many languages, many nations. This confusion is the result of the workings of sin. In the next few lessons we will consider the different races which now inhabit the earth.

LESSON IX.

The White Race.

Man is confined to no particular climate, as are the distinct species of animals, but can adapt himself to varying climatic conditions because of his ability to provide food, clothing, and shelter for himself. He is found in every zone, through all climes from the equator to the poles. The great variety of climatic and other external conditions have produced in the human family a great diversity of physical, mental, and moral qualities, and of social conditions. This difference of form, feature, temperament, color, and social condition, has given rise to a classification of the human family into groups, or races.

These different groups, however, are not so sharply defined that they can be regarded as distinct species, for in all climes, and under all circumstances, man retains certain common features of body and mind which mark the groups as belonging to one great family. Ethnologists do not all recognize the same number of races. They are sometimes classed from a geographical point of view, but we shall distinguish them by their color.

The white, or Caucasian, is the normal or typical race of men;—the primary race. This race occupies the mass of the Old World—Western Asia and India, Europe, and the Mediterranean region of Africa. Representatives of this race are distinguished by their tall stature, light, elastic step, and graceful proportions, their oval face and head, high, broad foreheads, symmetrical features and ruddy cheeks, their abundant beard, and waving or slightly curling hair. The color of the skin varies with the climate, from white in the European, to swarthy in the Hindoos, Arabs, and Egyptians.

The ancient sculptors left us their conception of the typical

man in the Apollo Belvidere, which is distinguished by perfect regularity of features and harmony in all the proportions of the figure, thus securing agility and strength in the highest degree, with the utmost beauty and grace. These ideal harmonies of proportion are realized in many individuals among the nations inhabiting the mountain lands of Iran, in western Asia, that region which Revelation, the traditions of the nations, and the affinities of their languages, all indicate as the cradle of the human race.

The Europeans and their American descendants have less regularity of features and harmony of proportions than the Persians and Armenians. Their faces, however, show more animation, more life and expression; the beauty is less physical, more moral and intellectual. Passing southward from the geographical center of the races, there is to be noticed a gradual modification or transition of types, through the Arab and Abyssinian to the true negro type.

From the center of Europe the white race has migrated to various parts of Africa and to the islands of the seas. They now possess the New World, the continent of Australia, and the great peninsula of India. The Christian religion and the civilization of modern times find their highest expression among the northern branches of this family, and it was a branch of this race which carried the ancient heathen civilization to its highest perfection. At present, it is this white race that is doing most toward colonizing, civilizing, and Christianizing the world. Is it doing all that it should?

References.—"Principles of True Science:" See Races. "Parts of His Ways," section 14, chapter 8. Physical Geography and Ethnology, see Races of Men.

LESSON X.

The Yellow Race.

The white, the yellow, and the black race are sometimes called the primary races, because they are much more clearly defined than the other types, which appear to be scarcely more than modifications of these primary divisions. Then, too, these three races occupy the three connected continents of the Old World. The yellow, or Mongolian, race occupies nearly all that portion of Asia not peopled by the whites, and contains among its members the Esquimaux, Lapps, Finns, Hungarians, and Turks.

Its branches have displayed marked mental powers, and, next after the Caucasians, have best developed themselves into nationalities and tribes. The Japanese and Chinese are very good types of the race, the Chinese being a much better one than the Japanese. They are characterized by their short stature, broad form and high shoulders, their round head, narrowing at the top, and wide, flat face, small chin, and prominent cheek-bones, which give the face a triangular outline. They have small, deep-set, oblique eyes, coarse, straight, black hair, and scanty beard. The Japanese are a very enterprising, energetic, and progressive people. They have adopted, to some extent, the customs and business methods of the western nations.

The Chinese have a unique form of government, which has been styled a parental monarchy. The emperor is the father of his people. He must rule in accordance with their ancient customs and laws, and must not be tyrannical. China is the seat of a very old civilization.

As early as 2000 B. C. the art of writing was known among these people, and printing from movable type was practised by them as early as the tenth or eleventh century. Chinese

literature was written principally by Confucius and Mencius. Their books are called the Nine Classics, and are said to be several thousand years old. They are practically the Chinese Bible, and teach the obedience of children to parents, and conformity to ancient customs. This has made Chinese children the most obedient children in the world; but the teaching of Confucius to "walk in the trodden paths," has caused a lack of originality in this people, and the unprogressive character of their civilization.

There are three leading religions in China,—Confucianism, Taoism, and Buddhism. The great sage Confucius is reverenced and worshiped throughout the empire. He holds somewhat the same relation to the system which bears his name that Christ holds to Christianity. Taoism takes its name from Tao, which is made the beginning of all things. There is one element common to all the religions of China, and that is the worship of ancestors. The Chinese reverence their ancestors, and pray and make offerings to the spirits of their forefathers.

References.—The same as in lesson 9.

Questions and Suggestions.—Is the Mongolian a primary or secondary race? Why? What other races are regarded as primary? How many races were there in the beginning? In what part of the world do we find the yellow race? What peoples are included in this race? Give the physical characteristics of a typical Mongolian. How do the mental powers of this race compare with those of the Caucasian? Are the Chinese progressive and enterprising, or are they very exclusive? What can you say of the Japanese in this respect? What form of government have the Chinese? How long ago was the art of writing known among them? Printing? How old are their greatest literary works? What are these books called? To what book in our homes may they be likened? What do they teach? Name the leading religions of the Chinese. Who was the founder of Confucianism? Taoism? Buddhism?

LESSON XI.

The Black Race.

Africa is the home of the black race. The negro (Latin, *niger,* meaning black) occupies all of that continent south of the Sahara Desert. He has lived there from time immemorial. Egyptian hieroglyphics tell of his existence in the wilds of Africa five thousand years ago, and he is there represented in picture and painting as we now find him. The African, or negro race, is of medium height, with the figure often ungainly. The hands and feet are large and flat, and the gait awkward. The forehead is low and retreating, and the head is elongated backward. The nose is broad and flat, the lips are thick, and the cheek-bones very prominent. The jaws are projecting; the hair is black, short, crisp, and woolly.

The Australians, occupying Australia and the adjacent islands, though sometimes regarded as a distinct race, sufficiently resemble the negro to be considered a branch of that race. Their form is still less symmetrical, and the features more irregular than in the black race. Their color is a livid grayish black; their hair is thick, waving, and bushy; the beard is abundant, and the eyes are very deep-set, black, and piercing. Of all the races the negro appears to be the least progressive, the least susceptible to the influences of civilization. In his own country he has made little or no progress, though he has dwelt there thousands of years.

Some races have given birth to a civilization of their own, or have at least preserved traces of a former higher civilization. For example, the Incas of Peru and the Aztecs of Mexico were found in a comparatively high state of civilization by Cortez and Pizarro. It is true that geographical and climatic conditions which prevail in the country of the black race are not the most favorable for the development, growth,

and spread of civilization; neither has the negro's contact with it been of a character to draw out his better qualities. Yet, in spite of these unfavorable conditions, we might expect to see more advancement than is apparent in this race to-day. That the negro has a capacity for a civilization, is shown by the progress made by certain individuals of that race who have been accorded all the educational advantages which the Caucasian in this country enjoys.

References.—The same as in lesson 9.

Questions and Suggestions.—What country is peopled by the black race? Is this race found in other countries? Was its spread to these various countries voluntary or forced? Are race characteristics, such as color, etc., permanent? Jer. 13:23. What can you say of the stature and characteristics of the negro race? Name other branches of this race, and give the principal distinguishing features between them and the typical African. Has the negro developed a high state of civilization in his own country? Give reasons for his not having done so. Has this race, generally speaking, much capacity for civilization? Do certain individuals of the race possess this capacity in a marked degree? What has occasioned the miserable condition of certain peoples of the Negro race? How may they be brought back to the plane God would have them occupy?

LESSON XII.

The Brown Race.

The brown, or Malayan, race occupies the islands which are washed by the Pacific Ocean and its adjacent seas, including the Malay Peninsula and the Indian Archipelago, and extending from Madagascar to the easternmost limits of Polynesia, and from the Sandwich Islands southward to New Zealand. The aborigines of Sumatra and Java, Borneo, the Celebes, and the Philippines, were all of this race. The features of the Malayan race are similar to those of the Mongolian, but their lips are thicker, their eyes are horizontal instead of oblique, and their hair not so straight. Their color is brown, varying in different tribes from olive-yellow to nearly black. The members of this race are of medium height, with well-

proportioned limbs. They are very fond of the sea, and appear, by means unknown to us, to have reached and occupied the islands of the sea generally.

Many of the branches of this tribe are still in the lowest stages of savage life, while some of them have a written language, and a legal code, and other remnants of a former civilization. Mohammedanism is the prevailing religion of this race. They believe that Mohammed was a prophet sent from God to be their leader; and, indeed, he did lead or rather drive them from the outward form of idolatry to a partial knowledge of the true God, by fighting unbelievers until no idolater was left to oppose him. He also promised all who should die for the faith an immediate and perfect happiness in heaven. Mohammed placed himself at the head of the government as well as at the head of the church. About one-fifth of the world's inhabitants are Mohammedans. The Koran is their Bible.

References.—The same as in lesson 9.

Questions and Suggestions.—Where do we find the brown race? Name some of the larger islands inhabited by them. Compare the features of the Malayan with those of the Mongolian, noting differences. Give the distinguishing characteristics of this race. What kind of life do they lead? What is their state of civilization? Of religion? Whom do they consider Mohammed to be? How did he "convert" idolaters? How does this method compare with that of our Saviour? Give a text of Scripture showing what we are to do in order that the people may be drawn to Christ.

LESSON XIII.

The Red Race.

The American Indians constitute the red race, which is considered by some to be simply an offshoot of the yellow race. At the beginning of the seventeenth century, this race was widely distributed over America, from the British possessions in the north, to Cape Horn in the south. Volumes have been written during the present century describing the physical and mental characteristics, the customs, religion, and civilization of the Indian. All sorts of virtues have been ascribed to him by his admirers; innumerable vices, by his less friendly and more critical biographers.

A great many erroneous ideas with reference to his mental and moral characteristics have been expressed; and, indeed, it is a difficult task to outline definitely just what these characteristics really are. The distinguishing physical features of the typical Indian are about as follows: Copper-colored skin, varying much in intensity in the northern and southern tribes, also in different members in the same tribe; high cheek-bones; straight, coarse, black hair; a rather sloping forehead, with the crest of the head full and prominent.

The Indian has an indomitable will and without complaint will endure great hardship and privation. The life of the American Indian, when the white man first trespassed upon his domains, was that of a hunter and warrior. Of necessity he was a hunter, because his primitive methods for cultivating the soil, and his restless, roving disposition made agriculture a very uncertain means of procuring a livelihood.

Then, too, the encroachments of neighboring hostile tribes often made it necessary for one band summarily to take their departure from the vicinity on which their crops were planted before these crops had ripened. Their principal agricultural

product was maize, or Indian corn, as we often call it. This grain, together with wild fowl, small animals, and in some sections the antelope, the deer, and the buffalo, constituted the primitive American's bill of fare.

The Indian's conception of social life, and his degree of civilization, are, perhaps, best illustrated by his treatment of the women of his tribe. Their position, at the best, is one of servitude. In the absence of their warrior lords upon the war-path or the chase, they are to hoe the corn and till the soil with crooked sticks or sharpened stones, grind meal from corn or nuts and bake it into loaves, make bows and arrows, moccasins and shields, gather wood and carry water, keep in order the wigwam, and do the thousand and one things which go to make up the domestic life of the Indian woman.

She is, in a literal sense, the burden-bearer of her family. When moving from one camp to another, it is she who packs upon her back the excess of household goods and papooses, and cheerfully trudges along behind the pony upon which her warrior husband complacently rides. Of course, when there are more ponies than warriors, the wigwams and their effects are carried by these extra ponies; and, should there still be ponies left unoccupied, even the women stand a chance to ride.

The religion of the Indian is a strange mixture of fact and fiction, of truth and tradition. He recognizes a "great spirit" whose favor means victory in battle, whose frown means defeat. He believes that if he has been a brave warrior and a successful hunter, when he dies he will be permitted to enter the "happy hunting-ground." He has traditions of the flood and of creation. When brought under the refining, civilizing influence of the Christian religion, the Indian, like all other members of the human family, reveals long-hidden traits of character beneath his rough, sin-scarred exterior, which mark him as the handiwork of God, created in the image of the Infinite.

References.—The same as in lesson 9.

Questions and Suggestions.—How widely distributed was the red race at the beginning of the seventeenth century? Why is it difficult to form a correct opinion with reference to the mental and moral characteristics, the customs and traditions of the Indian? What is the physical appearance of the typical Indian? How does it compare with that of the Mongolian? How does it contrast? Have attempts ever been made to subjugate the Indian? Were they successful? Why not? Does the Indian complain very much when he is hungry, tired, or when he is suffering physical pain? What was the occupation of the American aborigines? Did they cultivate the soil very extensively? What grain was raised by them? Upon what did they subsist? What can you say of the social condition of the Indian? Compare or contrast it with that of the various tribes of the brown race. What tasks are performed by the Indian women? What do the warriors do? What traditions of historical events are possessed by these people? What should the Christian strive to see beneath the rough exterior of the degraded races we have studied?

Chapter XV.

THE EARTH'S FINAL DESTRUCTION.

(Scripture Basis, 2 Peter 3:10–12.)

LESSON I.

The Final Warning.

1. When the Lord was about to destroy the earth by a flood, through whom did He send the message of warning?

2. Does the Lord bring destruction upon the earth without first giving warning to the people? Amos 3:7.

3. Did the Lord ever promise that He would not destroy the earth again by a flood of waters?

4. Will the Lord destroy the earth the second time? 2 Peter 3:5-7. What agency will He use to destroy it? *Id.*

5. Will there be a class of people living on the earth who will not receive the message regarding the final destruction of the earth by fire? 2 Peter 3:3, 4.

6. To whom does Christ compare the people who shall live in the last days?

7. Where do we find the message concerning the final destruction of the wicked? Rev. 14:9-12.

8. What two messages precede the third angel's message? Verses 6-8.

9. What is the burden of each of these three messages?

10. What call does God give to His own people? Rev. 18:4.

11. What will be the condition of the world just before the Lord comes? 2 Tim. 3:13.

12. What will be the great test under the third angel's message? *Ans.*—The keeping of the commandments of God. Rev. 14:12.

13. What is the power called which opposes the work of the third angel's message? Rev. 14:9.

14. What destruction awaits those who worship the beast and his image, and receive his mark? Verses 10, 11.

15. What reward awaits those who obtain the victory over the beast and his image? Rev. 15:1-4.

References.—"Parts of His Ways," section 15, chapter 1. "Principles of True Science:" See Fire and Water, "Great Controversy," chapter 38.

Suggestions to Teachers.—The Lord does not visit His judgments upon the earth without giving the people an opportunity to escape. As the Lord warned the world of the destruction by a flood of waters, so the world will be thoroughly warned with reference to its destruction by fire. The third angel's message contains this warning. The test which was brought upon the antediluvians was whether they would believe the word of God through Noah, and show their faith by entering into the ark with Noah and his family. The test which will determine the loyalty of the people when God is about to destroy the earth with fire, is the keeping of the Sabbath. The world in general to-day is keeping the first day of the week instead of the Sabbath of the Lord. Sunday is the sign of the power of the beast, which opposeth and exalteth itself against God. The Sabbath is the sign of the true God, who made the heavens and the earth. Those who acknowledge their allegiance to the beast will keep the first day of the week, instead of the Sabbath of the Lord, and thus will receive what is called the mark of the beast. The prophet John, in Revelation 14:12, speaks of a company which keeps the commandments of God. He speaks of this same company in Revelation 15:1-4, and says that he saw them standing on the sea of glass, having the harps of God in their hands, singing the song of Moses and the Lamb; for they had gotten the victory over the beast and his image and over his mark.

LESSON II.

The Time of Trouble.

1. Of what time does the prophet Daniel speak in Daniel 12 : 1?

2. How does this time of trouble compare with all other times in the past? *Id.*

3. What is the cause of the great controversy?

4. When the third angel's message closes, is there further opportunity for sinners to be saved? G. C., p. 613.

5. Is the time of trouble before probation closes, or after? G. C., pp. 613, 614.

6. Who has entire control of the wicked at that time?

7. In order to stand during the time of trouble, what must God's people possess? G. C., p. 621.

8. What great works will Satan perform during this trying hour? G. C., pp. 623, 624; Rev. 13 : 13; 2 Thess. 2 : 8-12.

9. What is the crowning act of Satan's deception? G. C., p. 624.

10. What phase of Christ's second coming will he not be able to impersonate? G. C., p. 625.

11. When Christ ceases His work of intercession in the sanctuary, what is poured out upon the wicked inhabitants of this world? *Ans.*—The seven last plagues. Revelation 16.

12. Describe the seven last plagues, and the fearful results which will follow from their being poured out upon the wicked.

13. How do the seven last plagues compare with the ten plagues which fell upon the Egyptians?

14. What portions of God's great works are used as agents of destruction during the seven last plagues?

15. Will these plagues fall upon the righteous? Ps. 91 : 10.

16. What will befall the wicked? Verses 7, 8. (Read the

ninety-first psalm, and see if it offers encouragement for those who will pass through the time of trouble.)

References.—"Parts of His Ways," section 15, chapter 2. "Great Controversy," chapter 39.

Suggestions to Teachers.—The time of trouble does not come until after the third angel's message has done its work. Then Christ ceases to plead in man's behalf, and the Spirit of God is withdrawn from the earth. Satan has entire control of the wicked. God's people have to stand in this time without a mediator; they have to wrestle with the powers of darkness as they have never done before. They are in the time of Jacob's trouble (read Genesis 32:24-32); but God does not leave His people. Angels are sent to minister unto them, to strengthen and encourage them, from time to time.

LESSON III.

The Deliverance of the Saints.

1. During the time of trouble what decree will be made with reference to God's people? G. C., p. 635.

2. In what different places are God's faithful children to be found? What are they doing?

3. How do the wicked feel toward the righteous? What takes place when the wicked are about to rush upon the righteous to destroy them? *Id.* How does this manifestation of the power of God affect the wicked? G. C., p. 636.

4. What do the people of God hear at this time?

5. What is the appearance of the heavens?

6. At what time does God manifest His power for the deliverance of His people? What strange occurrence takes place in connection with the sun? *Id.*

7. How does Nature seem to be affected? *Id.*

8. Describe the great earthquake which will take place under the seventh plague. Rev. 6:16, 18-20; G. C., pp. 636, 637.

9. What will happen to the mountains? Islands? Rocks? G. C., p. 637.

10. Describe the great hailstorm which will take place under the seventh plague. What will be the weight of a single hailstone in pounds? Rev. 16:21.

11. What will happen to the people of God who are held in bondage by prison walls? G. C., p. 637.

12. What is the voice of God from heaven heard to announce? G. C., p. 640.

13. What will appear soon after, in the east? Matt. 24:30; G. C., p. 640.

14. What is this cloud?

15. When Christ comes the second time, what will take place? 1 Thess. 4:14-16; John 5:28, 29.

16. Where will the righteous be taken after they meet the Lord in the air?

17. Should the theme of the second coming of Christ give us joy and comfort? 1 Thess. 4:18; Titus 2:13.

18. What will the righteous say when Christ appears in the heavens to redeem His people? Isa. 25:9.

References.—"Parts of His Ways," section 15, chapter 3. "Great Controversy," chapter 40.

Suggestions to Teachers.—The people of God have passed through the time of trouble, and Christ appears to take them to Himself. He gave this promise to His disciples when He was on earth, as recorded in John 14:1-3. When Christ was here, He showed that He had power over death and the grave in raising Jairus' daughter from the dead, the son of the widow of Nain, and Lazarus. In presenting this lesson to the pupils, they should be led to see that the true children of God will hail the coming of Christ with delight. They will look forward to that event with joyful anticipation, instead of with fear and dread. We should so live that we would be ready to meet the Lord should He come to-morrow.

LESSON IV.

The Desolation of the Earth.

1. What was the condition of the earth when it was first created?

2. To what condition was it brought by the flood?

3. What will destroy the earth the second time? 2 Peter 3:6, 7.

4. What works of destruction will take place during the time of trouble? Where in the Bible is this time of trouble mentioned?

5. Name the plagues, and describe their destructive work.

6. When Christ comes the second time, what will become of the righteous?

7. What will become of the wicked at that time? 2 Thess. 1:7-10.

8. What does Zechariah say of the destruction of the wicked? Zech. 14:12, 13.

9. What does Jeremiah say of those who are slain? Jer. 25:33.

10. What does the Word of God inform us will be the condition of the earth? Isa. 24:1, 3, 5, 6.

11. How will the whole earth appear? G. C., p. 657.

12. Will the earth, when Christ returns, be brought back to the chaotic condition mentioned in Genesis 1:2? Rev. 20:1-3; Jer. 4:23-27; G. C., pp. 658, 659.

13. How long will the earth remain in this desolate condition? Rev. 20:3; G. C., p. 659.

14. Where will Satan be during this time? What will be his condition? *Id.*

15. What will he do during the thousand years? G. C., p. 660.

16. Where will the righteous be? What will they be doing? 1 Cor. 4:5; Dan. 7:22; Rev. 20:4, 6.

17. Whom do the saints judge? 1 Cor. 6:2, 3; Jude 6; G. C., p. 660.

18. What takes place at the close of the thousand years? Rev. 20:5; Isa. 24:22.

References.—"Principles of True Science:" See Earth and World. "Parts of His Ways," section 15, chapter 4. "Great Controversy," chapter 41.

Suggestions to Teachers.—This lesson closes the chapter on the final destruction of the earth, and connects naturally with the next, and last chapter, The New Earth. The work of Satan is nearly done. He has a thousand years in which to meditate upon his wicked course. The saints are engaged in judging the wicked. When this work is completed, the judgment is visited upon the wicked, also upon Satan and his angels. The pupils should find these texts, and others in the Bible which bear upon this lesson. Although the earth and its inhabitants are visited with such great destruction, the apostle Peter sounds the note of courage when he says, "Nevertheless, we, according to His promise, look for a new heaven and a new earth, wherein dwelleth righteousness."

Chapter XVI.

THE NEW EARTH.

(Scripture Basis, 2 Peter 3:13; Isa. 65:17.)

LESSON I.

The Purifying of the Earth.

1. In what condition did we leave the earth in our last lesson?

2. Where was Satan? What was he doing?

3. What takes place after Satan has been bound for one thousand years? Rev. 20:7.

4. How many resurrections are spoken of in the Bible? Rev. 20:5, 6; Acts 24:15.

5. What descends on the earth at the close of the thousand years? Rev. 21:1, 2. Upon what mountain does the New Jerusalem rest? Zech. 14:4, 5, 9; G. C., p. 662.

6. When the wicked are raised, what does Satan cause them to believe? Rev. 20:7, 8; G. C., p. 663.

7. How do the wicked think they are raised from the dead? *Id.*

8. What can you say of the size of the wicked host? Of whom is it composed? *Id.*

9. Does Satan really believe he can capture the New Jerusalem? Why? G. C., pp. 663, 664.

10. What preparation is made to capture the city? *Id.*

11. Describe the attack upon the city? *Id.*

12. As they surround the city, what takes place? Rev. 20:9.

13. What influence does the fire from God have upon the wicked? Verse 10. Upon Satan? Eze. 28:18. Upon the evil angels? Jude 6; 2 Peter 2:4.

14. How is the earth affected by the fire? 2 Peter 3:10, 12.

15. Compare the destruction of the earth by fire with its destruction by water at the time of the flood. P. P., p. 672.

16. What will become of the elements of the earth? The works of the earth?

17. What does Peter say which gives us courage and hope, after he tells of the fearful destruction that is to take place? 2 Peter 3:13.

18. Where did he find that promise? Isa. 65:17.

19. Where do the righteous live after the destruction of the wicked? What city becomes the capital of the new earth? Rev. 21:1-4.

20. What admonition does Peter give to us in view of the destruction of the earth by fire? 2 Peter 3:11-14.

References.—"Principles of True Science:" See Earth and World. "Parts of His Ways," section 16, chapter 1. "Great Controversy," chapter 42.

Suggestions to Teachers.—This great conflagration destroys the earth, so that no vestige of the works of sin remains. The elements of the earth are melted, and the entire earth is purified by fire from God. The wicked, and even Satan, are reduced to ashes. The saints dwell once more in the earth, but it is in a very different condition. There is nothing to molest or to offend. The saints are purified, and now they live on a purified earth. In the next lesson we will take up the study of the vegetation of the new earth, and compare it with that which existed under the curse of sin. Following this will be a lesson on the animals of the new earth.

LESSON II.

Plants in the New Earth.

1. How many classes of plants did the Lord create in the beginning?

2. What did these plants need in order to grow?

3. Will there be plants in the new earth? Isa. 35:1; 55:13; G. C., p. 675; "Early Writings," p. 14.

4. Name some of the trees which will grow there. *Id.*

5. Will there be light, heat, air, water, etc., in the new earth to cause the plants to grow? Find texts giving proof.

6. What will be the sources of light? Will the sun and moon be brighter than they now are? G. C., p. 678; Isa. 30:26; Rev. 21:23-25; Isa. 60:19, 20.

7. What will be the condition of the atmosphere?

8. Describe the water of the new earth. Rev. 7:17; 21:1; 22:1, 2; G. C., p. 675.

9. What will be the condition of the earth's surface? G. C., p. 675.

10. Will Adam recognize the trees and flowers in the new earth? G. C., p. 648.

11. Will Eden be restored to the earth?

12. What tree will perpetuate life? Rev. 22:1-3; G. C., p. 645. Of what value will be the leaves? *Id.*

13. Will the curse be entirely removed from the plants?

14. Will there be many flowers? Will they fade after they are plucked?

15. What was Adam's occupation?

16. Will farming be carried on in the new earth? Will there ever be a failure of crops? *Id.*; Isa. 65:21, 22.

17. Will the new earth be a real place? Will it be just as real as the one in which we now live? G. C., pp. 674, 675.

18. Can we comprehend how glorious it will be? 1 Cor. 2:9; G. C., p. 675.

19. Should we often think of our new home and try to imagine what it will be? St. C., p. 98.

References.—"Principles of True Science:" See Fig-tree, Fir-tree, Myrtle-tree, Flowers, and Vegetation. "Parts of His Ways," section 16, chapter 2.

Suggestions to Teachers.—In this lesson impress on the minds of the children that the new earth will be a real place, that there will be trees, flowers, grass, sun and moon, water, plants, hills, and mountains, but that they will be very beautiful, the curse of sin having been removed. There will be no pain, death, sorrow, or crying; for all things have been made new. Revelation 21. In the next lesson we will study the animals which will live in the new earth.

LESSON III.

Animals in the New Earth.

1. Describe the plants which grew in the beginning.

2. What effect has sin had upon the plants?

3. How were they affected by the flood?

4. Will there be plants in the new earth? Name some of the plants which will grow there.

5. Will there be animals in the new earth? *Ans.*—There will be there:—

(*a*) The lion. Isa. 65:25; 11:7.
(*b*) The bear. Isa. 11:7.
(*c*) The cow. *Id.*
(*d*) The wolf. Isa. 11:6; 65:25.
(*e*) The serpent. Isa. 65:25.
(*f*) The leopard. Isa. 11:6.

6. What can you say as to the disposition of the animals which will live in the new earth? Isa. 11:6, 8.

7. Of what service will the animals be?

8. Will there be anything in the new earth which will hurt or destroy? Isa. 65:25; 11:9.

9. What beings besides the animals will have changed their dispositions?

10. Will the same animals live in the new earth that have lived on this earth?

11. Are the lower animals responsible to God for the wrong things they do? If not, who is responsible?

12. For what purpose did God create the lower animals in the beginning? Will this purpose be carried out?

References.—"Principles of True Science:" Animals in the New Earth, "Testimonies for the Church," vol. 1, p. 68; Wolf Shall Dwell with the Lamb, "Great Controversy," p. 675; Lion Sported at Adam's Feet, "Patriarchs and Prophets," p. 50. "Parts of His Ways," section 16, chapter 3.

Suggestions to Teachers.—We learn from the study of the Bible that there will be animals in the new earth. Not only the tame and gentle animals will live there, such as the lamb and cow, but also the wild and ferocious creatures, such as the bear, wolf, and lion. But they will all be gentle and kind, so that even a little child can lead them. Teach the children to see that the new earth would not be like this one when it was first created if it should not contain plants and animals. God's original purpose with reference to the plants and animals, as well as to man, will yet be carried out. The next lesson will be about man in the new earth.

LESSON IV.

Man in the New Earth.

1. Who were created as the representatives of the human family?

2. What position did man occupy in the world when he was placed in Eden?

3. How did he lose his dominion?

4. What plan has God devised whereby he may regain it? Explain the plan of redemption.

5. Will Adam and Eve be redeemed? G. C., p. 644.

6. Will they recognize their Edenic home? G. C., p. 648.

7. What was the physical appearance of Adam and Eve before they sinned?

8. What will be their condition when they are redeemed? What will be the condition of the redeemed? G. C., p. 644.

9. What contrast is seen between Adam and his children as to their physical condition? What does this show? *Id.*

10. Are there blemishes or deformities now seen in the human race? G. C., p. 645.

11. Will the redeemed ever suffer from physical weariness? G. C., p. 676.

12. What will be their intellectual condition? G. C., p. 677; Isa. 11:6, 9; 33:24; 62:3; 65:19.

13. How will the redeemed spend their time? G. C., pp. 675, 677.

14. Will they enjoy working? Isa. 65:22.

15. Do you think there will be lazy people in the new earth?

16. Does the Word of God condemn laziness? Where?

17. Will success always attend the work of the saints? G. C., p. 677.

18. May we have success even in this life? How? Joshua 1:6-8.

19. What will be the two great themes of study in the new earth? *Ans.*—Creation and redemption. G. C., p. 677.

20. Who will be the teachers? *Ans.*—The Great Teacher Himself and the angels. *Id.*

21. What two great themes have we been studying during the past year?

22. Which chapters come under creation? Under redemption? What benefit have you derived from your study of God's wonderful works?

References.—"Principles of True Science:" Man in the New Earth, "Great Controversy," p. 644; God's Works, the Study of the Redeemed, "Great Controversy," pp. 677, 678; Dwellings outside of New Jerusalem, "Early Writings," p. 13; "Testimonies for the Church," vol. 1, p. 68. "Parts of His Ways," section 16, chapter 4.

Suggestions to Teachers.—Not only are the plants and animals to be found in the new earth, but man also—the ruler over all that God has placed in the earth—is restored to his original place. It was on account of man's sin that the earth was cursed. Those who accept of

God's plan of salvation will have a home in the earth made new, and find all things restored to their Edenic perfection and beauty. Man's powers of mind and body will be restored, so that he will never be weary or suffer pain. He will till the soil, and engage in the study of God's creation; also he will contemplate the wonderful creative power that has been exercised in his salvation. Through all eternity the grand themes of creation and redemption will be subjects which he will delight to study.

LESSON V.

A Clean Universe.

1. What was God's purpose in creating this world? Isa. 45:18.

2. After creating the world, what steps were taken to make it a beautiful home for man?

3. When the entire work of creation was completed, what did the Creator say of it? Gen. 1:31.

4. With what feelings did the angels behold it? Job 38:7.

5. Who determined to destroy the peace and happiness of this world? Where had Satan brought in unhappiness and confusion before?

6. What has been the influence of sin upon the beautiful creation of God?

7. What has Satan been doing during the past six thousand years? What has Christ been doing?

8. Through what means will the earth be purified?

9. What great controversy will be ended when the earth is purified?

10. How will the saints express their gratitude to God at this time? G. C., p. 678.

11. What mighty chorus of praise did John the revelator hear, which will be sung at this grand reunion? Rev. 5:11-13.

12. Who will join in this song? Where are they at this time? *Id.*

13. What is the condition of things throughout the entire universe? G. C., p. 678.

14. What does the entire creation declare with reference to the Creator? *Id.*

15. Are we living near the time when God's original purpose will be carried out?

16. At what period are we living in the accomplishment of God's plan of redemption?

17. What relation do we sustain to God's great plan in creation and redemption?

18. Does our eternal destiny depend upon how we relate ourselves to God's great plan?

References.—"Principles of True Science:" See Universe, Eden, and Garden of Eden. "Parts of His Ways," section 16, chapter 5.

Suggestions to Teachers.—When the saints possess the new earth, they will continually ascribe praise to God and Christ for their wonderful salvation. The great chorus of praise is described in Rev. 5:11-13. "The great controversy is ended. Sin and sinners are no more. The entire universe is clean. One pulse of harmony and gladness beats through the vast creation. From Him who created all, flow life and light and gladness throughout the realms of illimitable space. From the minutest atom to the great world, all things, animate and inanimate, in their unshadowed beauty and perfect joy, declare that God is love." —Great Controversy, p. 678. This closes this series of lessons, and has placed before the pupils God's great plan of creation and redemption. The same general plan of study should be carried out next year, only going a little deeper into each subject. This plan of study may be continued until the pupils are twelve to fifteen years of age. After this time, they can take up separate phases of nature for deeper and more thorough study, such as botany, zoology, astronomy, etc.

Books.

Below is given a list of Nature-Study books which the author has examined, and which he believes will be helpful to parents and teachers in teaching the Bible-Nature Study Lessons.

Familiar Life in Field and Forest................*Mathews*
Bird Life ....*Chapman*
Facts and Phases of Animal Life................*Morwood*
A World of Wonders.
The Wonders of Marine Life.
In Brook and Bayou.............................*Bayliss*
Familiar Features of the Roadside..............*Mathews*
The Oak ....*Ward*
The Plant World ....*Vincent*
The Story of the Cotton Plant...................*Wilkinson*
The Story of Electricity.........................*Munro*
The Story of a Piece of Coal.....................*Martin*
The Story of Plants..............................*Allen*
News from the Birds.............................*Keyser*
About the Weather ....*Herrington*
Plant Relations ....*Coulter*
The Insect World ....*Weed*
Familiar Trees and Their Leaves.................*Mathews*
Uncle Robert's Geography, Vols. 1-3.........*Parker & Helm*
Familiar Flowers of Field and Garden............*Mathews*
The Story of the Birds..........................*Baskett*
Sound ....*Mayer*
The Story of the Atmosphere.....................*Archibald*

Curious Homes and Their Tenants................*Beard*
Light ....*Mayer & Barnard*
Practical Agriculture ....*James*
Published by D. Appleton & Co., N. Y.
Nature's Wonders ....*Carrington*
Wonderful Tools ....*Carrington*
Featherland .... *Fenn*
Ages Ago ....*Carrington*
Poor Blossoms.
Friendship of Animals ....*Carrington*
Parables from Nature.
From Many Lands ....*Carrington*
Animal Ways and Claims ....*Carrington*
Man's Helpers ....*Carrington*
Published by George Bell & Sons, London.
Lessons in Nature Study................*Jenkins & Kellogg*
Studies in Entomology ....*Bland*
Elementary Practical Chemistry ....*Cooper*
Published by Whittaker & Ray Co., San Francisco, Cal.
Glimpses of the Animate World.................*Johonnot*
Short Stories of Our Shy Neighbors................*Kelly*
Elements of Astronomy ....*Lockyer*
Steele's New Astronomy.
Practical Flora ....*Willis*
Published by American Book Co., Chicago.
School Entomology ....*Cooke*
Published by Bancroft & Co., San Francisco, Cal.
Wild Flowers of California......................*Parsons*
Published by Payot, Upham & Co., San Francisco.
Child's Book of Health.........................*Blaisdell*
How to Keep Well..............................*Blaisdell*
Published by Ginn & Co., Boston.
The Clock of Nature..........................*MacMillan*

Object Lessons for Infants, Vols. 1 and 2..........*Murche*
Object Lessons in Elementary Science, Vols. 1-3....*Murche*
Object Lessons in Elementary Science and Geography
Combined, Vols. 1 and 2.....................*Murche*
Nature Study in Elementary Schools................*Wilson*
The Population of an Old Pear Tree..............*Bruyssel*
Murche's Science Readers, Vols. 1-6.
The Animal World.............................*Vincent*
Wild Neighbors ....*Ingersol*
Short Stories in Nature Knowledge...................*Gee*
The Nature and Work of Plants...............*MacDougal*
Introduction to Zoology.........................*Lindsey*
Hand-book of Nature Study.........................*Lange*
The Spring of Day............................*MacMillan*
Botany for Beginners.............................*Evans*
Nature Study for Grammar Grades...............*Jackman*
The Soil ....*King*
Garden Making ....*Bailey*
First Lessons on Plants..........................*Bailey*
Four-Footed Americans ....*Wright*
Published by MacMillan & Co., N. Y.
Nature Study Readers, Vols. 1-3...................*Troeger*
Man and His Work............................*Herbertson*
Published by Adam and Charles Black, London.
Introduction to Botany..........................*Spaulding*
Published by D. C. Heath & Co., Boston.
Wild Animals I Have Known.............*Seton-Thompson*
Published by Charles Scribner's Sons, N. Y.

Scriptural Index.

Genesis.

Exodus.

Leviticus.

Numbers.

Deuteronomy.

Joshua.

Judges.

1 Samuel.

1 Kings.

2 Kings.

1 Chronicles.

1 John.

3 John.

Jude.

Revelation.

Revelation—Cont.

Revelation—Cont.

33

General Index.